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MACKENZIE VALLEY PIPELINE INQUIRY

IN THE MATTER OF APPLICATIONS BY EACH OF
(a) CANADIAN ARCTIC GAS PIPELINE LIMITED FOR A
RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS
CROWN LANDS WITHIN THE YUKON TERRITORY AND
THE NORTHWEST TERRITORIES, and
(b) FOOTHILLS PIPE LINES LTD. FOR A RIGHT-OF-WAY
THAT MIGHT BE GRANTED ACROSS CROWN LANDS
WITHIN THE NORTHWEST TERRITORIES
FOR THE PURPOSE OF A PROPOSED MACKENZIE VALLEY PIPELINE

and

IN THE MATTER OF THE SOCIAL, ENVIRONMENTAL AND
ECONOMIC IMPACT REGIONALLY OF THE CONSTRUCTION,
OPERATION AND SUBSEQUENT ABANDONMENT OF THE ABOVE
PROPOSED PIPELINE

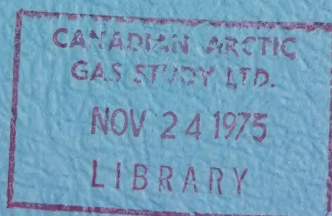
(Before the Honourable Mr. Justice Berger, Commissioner)

Yellowknife, N.W.T.,

November 4, 1975.

PROCEEDINGS AT INQUIRY

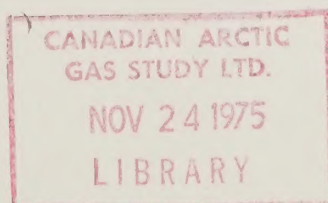
Volume 80



APPEARANCES:

Mr. Ian G. Scott, Q.C.
Mr. Stephen T. Goudge,
Mr. Alick Ryder and
Mr. Ian Roland for Mackenzie Valley
Pipeline Inquiry;
Mr. Pierre Genest, Q.C.
Mr. Jack Marshall,
Mr. Darryl Carter, and
for Canadian Arctic Gas
Pipeline Limited;
Mr. Reginald Gibbs, Q.C.
Mr. Alan Hollingworth for Foothills Pipelines
Ltd.;
Mr. Russell Anthony,
Prof, Alastair Lucas for Canadian Arctic
Resources Committee;
Mr. Glen W. Bell and
Mr. Gerry Sutton for Northwest Territories
Indian Brotherhood and
Metis Association of the
Northwest Territories;
Mr. John Bayly for Inuit Tapirisat of
Canada and the
committee for Original
Peoples Entitlement;
Mr. Ron Veale and
Mr. Allen Lueck for the council for the
Yukon Indians
Mr. Carson H. Templeton for Environment Protect-
ion Board;
Mr. David Reesor for Northwest Territories
Association of Muni-
cipalities
Mr. Murray Sigler for Northwest Territories
Chamber of Commerce

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I N D E X

Page

WITNESSES FOR CANADIAN ARCTIC GAS PIPELINE LIMITED:

John Ivor CLARK

Donald DABBS

R.L. HARLAN

R.A. HEMSTOCK

C.M. KOSKIMAKI

Peter J. McCART

Gretchin V. MINNING

Guy Leslie WILLIAMS

11769

- Cross-Examination by Mr. Hollingworth (cont)

11848

- CrossExamination by Mr. Anthony

EXHIBITS:

305 Progress Report, CAGSL, Revegetation Studies
North of 60, dated September 1974

11772

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth
Yellowknife, N.W.T.

November 4, 1975.

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

THE COMMISSIONER: Well, Mr.
Hollingworth, you might carry on.

MR. MARSHALL: Excuse me, sir,
there are two matters. We have available the evidence
for the Arctic Gas panel that will deal with the impact
on the living environment, and I'm handing it out to
the counsel who are here. It does not contain any
evidence from Dr. Banfield. We intend to call him as
part of the panel. He is still away in Scotland and
we hope to have some evidence from him next week and
we'll distribute it as soon as it's available.

There's a second matter, sir.
We've had prepared a small amendment to Exhibit 57,
which is the environmental impact statement for north
of 60, pertaining to paragraph 7.4.2, on operation
effects dealing with the air quality.

There were some changes in
some of the figures and I had the paragraph re-typed
and have copies of it. I'd like to file one copy with
Miss Hutchinson and distribute the other to counsel.
Thank you, sir.

JOHN IVOR CLARK
DONALD L. DABBS
R.L. HARLAN
R.A. HEMSTOCK,
C.M. KOSKIMAKI,
PETER J. McCART,
GRETCHIN V. MINNING,
GUY LESLIE WILLIAMS,

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Hollingworth

CROSS-EXAMINATION BY MR. HOLLINGWORTH (CONTINUED):

Q Mr. Dabbs, unfortunately we don't have the benefit of the transcript from yesterday. I just wanted to clarify what it was your statement was when we were discussing shrub cuttings. I believe you were talking about the success rate that you had had with willow; and perhaps you could give me your testimony again on that point as to what your success rate was.

WITNESS DABBS: The figure, if you want it precisely, is given in the progress report, 1974, as ranging as high as 94% and averaging 70%. I believe I used a higher figure than that which was based on a first year's results, which is in the Biological Report series, Volume II, which is 90 to 100%, depending on the willow species.

Q Yes, well that's the point that interested me because when I looked in the progress report it showed a range of 35 to 94%, with an average of 70%. Isn't that correct?

A In the progress report of September '74, that is quite right.

Q And on page 20 of the Biological Report series, there were test percentages, five test percentages given, they were 94%, 83%, 22%, 96%, and 83%?

A Yes, I stand corrected. In that case I see the 100% was with the Alders Shepherdia of Canada.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1

2

Q Which? Sorry.

3

A Alders and soapberry

4

is the common name for shepherdia.

5

Q All right, thank you.

6

Yesterday I think when we broke off we were discussing

7

what seed you had in commercial quantities from native

8

varieties, and I think we were discussing particularly

9

arctagrostis latifolia and for the benefit of my

10

friends who have been complaining somewhat, I'll refer

11

to that now as polar grass and also bluejoint I think

12

you have seeded in commercial quantities, and those

13

figures are given on page 52 of your progress report.

14

A Yes, I have that, and

15

we were at this precise point, yes.

16

Q Do you still have that

17

seed?

18

A Much of that seed has

19

been used in the past year in experimental programs in

20

our greenhouse at Calgary, and at the plot established

21

at LeCrate in Northern Alberta. We have, however,

22

since this report was prepared, collected additional

23

seed this past summer, the summer of 1975.

24

Q So do you now have a

25

similar or larger quantity than that listed on page

26

52?

27

A I don't have with me an

28

estimate of the seed. I don't believe it has been

29

thrashed as yet. It's hand-collected with sickles and

30

the flower heads placed in bags, dried and returned to

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1 ||
2 || Calgary, but I'm certain we would have more than 28
3 || pounds calamagrostis.

4 || Q Well, on page 48 of that
5 || same progress report there's a discussion of the poten-
6 || tial rate of seed production and my question is, does
7 || that take into account the dormancy and flowering
8 || mechanism problems that we've discussed, that we were
9 || speaking of yesterday?

10 || (PROGRESS REPORT, CAGSL, REVEGETATION STUDIES
11 || NORTH OF 60 DATED SEPTEMBER 1974 MARKED EXHIBIT
12 || 305)

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams--Cross-Exam by Hollingworth

A I think the important point right in the middle of the page is the assumptions and they are strictly that. They are assumptions at this point in time. We are not certain that even our assumptions are to be fairly accurate.

Q Well, do those assumptions take into account the flowering mechanism and dormancy problems we were discussing yesterday or do those assumptions assume that no such problems exist?

A I believe those assumptions are based on the belief that we can overcome the problems. For instance, as I said yesterday the *Salix rostrata* collected in the [redacted] Valley, there is no problem with germination and flowering there. The deco type gardens at Calgary, Maclellan and Inuvik would show that at least that species will bloom and set seed and I said yesterday that *arctagrostis* from the Tuk area appears to have other requirements for flowering and that is still being worked on.

Q What if you did not have this dormancy in flowering mechanism problems? Do you agree with me that you have already got sufficient seed that in two to four years you would have enough to amply cover all of the right-of-way that you are proposing for your project?

A Well, that is a--again you are making the assumption that we will not encounter any cultural problems.

Q Well, I am using your

Clark, William, William, William
 William, William, William, William
 William, William, William, William
 William, William, William, William

assumptions.

the are conservative and I believe that the
 most well-climatic situations will be produced
 reasonable to expect that a large amount of seed
 be produced or otherwise we would not still be
 pursuing the project. We, ourselves, are optimistic
 that seed of these species can be produced for use
 on the pipeline or Arctic Gas would not continue to
 pursue it. But I think as anyone that has any
 agricultural background as I believe you have
 have experienced the problems of the variability of
 climate, production of seed. We have had a lot of seed
 under contract for the last year and the
 takes is one hail storm as we experienced this summer
 that wipes out a field, so those are the type of
 cultural problems I refer to that you would experience.

Q All right. But putting
 those aside for the moment and using your assumptions,
 is it not right that you would have to use up
 your entire right-of-way, to see how much seed you
 way in two to four years using the stock you already
 have on hand?

A Without myself taking any
 calculation running it out, I could not say with
 confidence but I would say that I think it is
 believe that quantities sufficient for use as planned
 could be and will be produced. The point should be
 made here that it is a matter of what percentage are
 we talking about? Are we talking 100% of all the seed

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Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Hollingworth

which amounts to something in excess of a million
or are we talking 5% of the seed mix being
native. And when I say that, I am optimistic that
natives can be produced in sufficient quantity. I speak
of the lower percentage.

Q Now, I suggest to you
that using the figures that you have given and your
assumptions and taking the stock that you have listed
on Page 52 of the progress report that in four years
you would have well in excess of a million pounds of
seed. Do you have any reason to disagree with that?

A There is no reason to
disagree except on the basis of simple logic and
experience of an agricultural background that you simply
do not count on things that well. If every farmer
could get forty bushels to the acre as he expects of
course, they would all be millionaires.

Q Well then your assumptions
are somewhat lacking, is that what you are saying?

A Well, the assumptions
are conservative and I would agree with you that if
everything went just as we assume, yes, we could produce
that quantity of seed.

Q Thank you. Now, yesterday
we were discussing agronomic and need of varieties and
believe your evidence was to the effect that you were
trying to get the best of both worlds. That you would
use agronomic varieties to obtain fast ground cover in
the first year or two and then the native varieties would
take over so that you would have the best of both.

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams

Cross-Exam by Hollingworth

coverage thereafter because the agronomic varieties die out. Is that a fair summary of what you are saying?

A That is a fair summary.

Q Now, if you could find native varieties which gave this adequate ground cover in the first year or two, would you prefer to use those to the agronomic varieties?

A Yes, I would say we would prefer if they could be found. No one has found them as yet that we are aware of.

Q Well, is the basis for your using agronomic varieties merely that you think that the ground coverage is better in the first year or two? Is that the only reason for using them?

A Ground cover and root production. We speak of our principle objective, our first objective being one of erosion control. This relates to both top and ^{root} biomass production and research that we have had underway in the past year--a greenhouse in Calgary--where we have cold soil simulation equipment where we can grow natives and agronomics together under precise conditions, we find that the agronomics can persistently produce two or three times the root and top biomass that the natives do under cold soils.

Q Are you distinguishing between root production and the top biomass production?

A In the sampling, yes we do.

Q Yesterday, you discussed your tests at Inuvik, I believe, where you obtained

Clark, Duggs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Hollingworth

results with agronomic varieties.

A In the first year.

Q In the first year?

A Right.

Q Do you have any other

data that shows agronomic varieties perform better
in the first year?

A The information I am
alluding to in the greenhouse, yes.

Q In the greenhouse in

A Yes.

Q Do you have a study or a

in connection with those tests?

A It is in preparation.

Q And is that the one that you

stated that you were going to produce yesterday?

A And that was the progress
report on Sans Sault work.

Q Could you also produce the
report on Calgary when you have it prepared?

A Certainly.

Q And do you have any other
tests that show that agronomic varieties perform better
in the first year?

A Not that I can think of
at the moment.

Q Dr. Mitchell, I believe,
has been doing most of this testing for you?

A Dr. Mitchell's work has

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Hollingworth

1 been two parts. One that the Prudhoe Bay test site
2 is a sub-contractor to Audel's Columbia test which
3 was for the Gas Arctic group, as well as in the past
4 two years, he has had two separate projects conducted.
5 One is strictly funded by Arctic Gas, the other funded
6 by a joint group ARCO being the operator, Canadian
7 Arctic Gas being one of the participants.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Hollingworth

Q And would you agree with
me that at least six tests that Mitchell has conducted
he has found that native varieties performed equally
to, or better than the agronomic varieties in the first
year?

A Without reviewing his
reports, I couldn't say, but I expect if you've found
that in his report, I agree with Dr. Mitchell's work.

MR. MARSHALL: Perhaps Mr.
Hollingworth could indicate what specific report it is
so that Mr. Dabbs might be able to take a look at that?

MR. HOLLINGWORTH: Well, tests,
and I can refer them specifically one by one if you like,
but the tests are found in the document entitled:

"Progress Report, 1974, Tundra Rehabilitation
Research, Prudhoe Bay and Palmer Research Centre."
That's for the Alyeska Pipeline Service Company, Atlantic
Richfield, CAGSL, Exxon, Shell and Union; it's conducted
by the Institute of Agricultural Sciences of the Uni-
versity of Alaska, Palmer Research Centre, February 10,
1975.

Q Now on page 11 of
Appendix "C", Mr. Dabbs, in Section 5.3 --

A Yes?

Q -- you mention fertilizers
and a mix of 56 - 112 - 56.

A Yes.

Q I understand that's a
mixture of 56 parts nitrogen, 112 parts phosphorus,
and 56 parts potassium. Is that correct?

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1

2

A That's right.

3

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Q Are you using the same
mix from the 60th Parallel up to the Arctic Coast and
along the coast to Prudhoe?

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A If you see the references
given there, they cover Inuvik, Tuk, Prudhoe Bay, San
Sault, Norman Wells area, and we have all found
essentially that same combination as being the most
appropriate at this time. The other information we
have based this on is Jans & Reed, Hettinger et al
'73, which were extensive soil sampling and testing
programs in North-eastern Alaska, Northern Yukon, and
the Mackenzie Valley, and we found that the nutrient
levels in the sub-surface material, the parent materials
which will be brought to the surface by excavation and
construction of a pipeline are uniformly deficient in
the nutrients required for the growth of grasses,
either the natives or agronomics and the experimental
results^{of}/work to date by these various authors have
led everyone to conclude that this is the most appro-
priate kind of rate of application at this time.

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Q So your answer is "Yes."

A That's right.

Q And what rate are you
applying to this fertilizer, or are you proposing to
apply?

A It says right there,

56 - 112 - 56 kilograms per hectare.

Q Kilograms per hectare.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

A That's right.

Q And just so I'm sure,
are you saying that it's going to be applied in this
proportion along the Arctic coast areas? I think you
said "yes", eh?

A In the Yukon where I would
say "yes", we have found areas in Alaska near the
Saddlerochit Mountains where the iron content in
soil is very high, which of course binds the phosphorous,
and we may in those cases have to go to a higher rate
of application of phosphorous.

Q I'm a little confused
because the second to last sentence in 5.3 says:

"Fertilizer specifications for tundra areas
have not yet been developed, but considerable
data from successful research projects are
available and are under review to aid in this
development."

Is this presently under study by Arctic Gas as such?

A Yes, it is. If you recall
I said this is the combination at this time.

Q Let me refer you to
your Biological Report series, Volume II, page 28.
The last complete paragraph, the last sentence says,
speaking to the rate of application, it says:

"As this is even higher than the heaviest
rate used at San Sault, Table 2, it is
evident that fertilizer requirements are not
uniform throughout the northern end of the

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

proposed pipeline route."

Now that is in your Biological Report series. Why are you now applying it at a uniform rate?

A My comment on the Biological Report series is several years ago, the report, Appendix "C", is the current -- our current review of data information and we feel that at this time that the rate proposed in Appendix "C" is the most appropriate first coverage of fertilizer, first application. It's a matter of evolution of time and additional work and examination of results and consultation with other researchers that I ^{find} reference in this Volume II.

Q Now could you turn to Table 1, which is on page 4 of Appendix "C"? I'm looking at the last column on the right, and where it is marked by an asterisk I understand that figure at the top there, for instance 30% with creeping red fescue, would be the living cover in 1974 and because of the asterisk marking greater than 50% cover of living and dead, I could assume that at least 20% of the cover is dead.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

A The 30% is living.

Asterisk means that there is additional coverage of
dead plant material resulting in 50% or more ground
cover.

Q So that at least 20%
would be dead cover, because you deduct 30 from 50 and
you arrive at 20.

A Yes, that's correct.

Q And the same with the
45% and the 12% and the 24% and the 23% and the 23%
and so on down the column?

A That's right.

Q Now, obviously the
basic goal of your scheme is to encourage the re-
establishment of native plant communities. Would that
be a fair assumption?

A That's been stated.

Q Well, isn't this dead
ground cover going to inhibit such re-establishment?

A No, it doesn't. The
appendix to the Volume II, certainly the results of
San Sault work subsequent to Volume II has shown quite
clearly the establishment and recovery of a very large
number of the native species and at the end of five
growing seasons, which is this past year, the litter
accumulation, top growth, dead growth of grasses did
certainly not impair the recovery of native species.

Q Excuse me a moment.

A The top growth is

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Hollingworth

1 sub-surface material is a conditioner that, unless it's
2 excessive, is in itself promotes the recovery and
3 establishment of native species.
4

5 Q Well, Mr. Dabbs, would
6 you look at page 18 of your progress report that was
7 filed yesterday as Exhibit 305? The first sentence
8 of the last paragraph there reads:

9 "The data suggests that the cover importance
10 of native species invading the seeded plots
11 is inversely proportional to the amount of
12 total cover produced by the seeded grasses,
13 the function of both species success on the
14 rate of fertilizer application."

15 Well, first of all what do you mean by "cover importance"
16 in that statement?

17 A The importance or the
18 contribution to the total plant cover on a plot or on
19 a given unit area, which is made up of native species.

20 Q So in other words what
21 that statement says is that ^{if} you've got a lot of seeded
22 grasses, then ^{you need} the importance of native varieties coming
23 in as well?

24 A It says just what I just
25 finished saying, as long as you do not obtain too high
26 or too heavy a growth of grass top from seeded grasses
27 you get natives invading, and the statement is quite
clear that in a plot that is excessively seeded with
high rates of seeding, with high rates of fertilizer
and subsequent fertilization, the natives are impaired

Clark, Dabbs, Harlan Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1 by their invasion:

2 Q All right, well you have
3 no problems then with dead ground cover.

4 A Not unless it is excessive.

5 Q What about as fire hazard?

6 A The combustibility of
7 dead grass on a right-of-way is considerably less than
8 the volatile lichens and black spruce that border the
9 right-of-way, so it does not present a fire hazard as
10 great as the plant communities.

11 Q Well, weren't agronomic
12 varieties used to re-seed the Pointed Mountain Pipeline?

13 A I believe so.

14 Q And wasn't there
15 criticism by Miss Van Ike in her report on Pointed
16 Mountain about the fire hazard from the agronomic
17 varieties that had died?

18 A I believe so. It's been
19 some time since I read her report.

20 Q Do you agree or disagree
21 with Miss Van Ike on that point?

22 A I say that I agree to a
23 point in that area, speaking of forest cover, a different
24 fuel type entirely than the Mackenzie Valley.

25 Q Well, does this dead
26 ground cover aid in erosion control at all?

27 A It does in part because
28 it breaks up rainfall.

29 Q Would you call it a
30 significant aid?

Clark, Dabbs, Harlan, Hemstock;
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1 A Not as significant aid
2 as the plant roots and stems themselves.

3 Q Well, apart from erosion
4 control, are there any positive aspects at all in
5 having that dead ground cover?

6 A Not really, but you can't
7 grow plants of any type without dead material being
8 deposited.

9 Q Why?

10 A Because really decomposi-
11 tion is slow to compensate for the rate of production,
12 naturally or in the case of a right-of-way.

13 Q You're saying that you
14 have to have dead plant life in order to sustain further
15 growth?

16 A No, I say that further
17 growth results in more dead plant life.

18 Q O.K.

19 A I think the important
20 point here is the fact that there is such an accumulation
21 of dead plant life naturally, that's what the forest
22 cover ground litter essentially is, is a buildup of
23 dead plant life that results in the maintenance of
24 permafrost naturally.

25 Q Would you turn to page
26 11, Appendix "A", please? You say in paragraph 5.2:

27 "The seed specifications for the initial
28 seeding are generally a combination of slow
29 establishing hardy species with faster estab-
30 lishing less hardy species in an attempt to

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1 optimize both immediate erosion protection
2 and longevity."

3 Now, could you tell me which of these slow developing
4 hardy species are indicated on Table 1 of your
5 appendix?

6 A Yes, the Arctared creeping
7 red fescue, and nugget Kentucky blue grass are slightly
8 slower and ^{certainly} somewhat longer growing than Engmo timothy
9 and timothy as demonstrated as I showed in the slides
10 yesterday, has the ability to establish very quickly
11 and produce a considerable ground cover.

12 Common meadow foxtail is
13 slightly slower establishing, but longer-lived than the
14 timothy.

15 Q Well, looking at the
16 Table 1, the Mitchell tests at Prudhoe Bay seem to
17 indicate creeping red fescue had a substantial cover
18 rate, that's 54% in 1974; but the Kentucky nugget
19 bluegrass has a coverage of 3% in 1974. That's the
20 third year, is that not right?

21 A Yes.

22 Q So would you be using
23 that with such a low success rate?

24 A Are you talking about
25 plots at Prudhoe Bay, and over here we're talking about
26 a situation that spans from the tundra area through
27 to a forested area? Yes, we would use Kentucky blue-
28 grass, the nugget variety in the northern regions.
29 Nugget has been specifically selected as a variety in
30

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1 Alaska and throughout the cooler regions, it's success
2 adjacent to the Beaufort Sea and Prudhoe Bay is
3 adequate for inclusion in seed mixes in the northern
4 tundra areas. The results of growth of nugget Kentucky
5 blue, rig site seeding in the Mackenzie Delta has
6 demonstrated its value in the seed mix also.

7 Q Well, I'm just looking
8 at nugget blue then for the San Sault test conducted
9 by Younkin & Friesen in the last column on Table 1.
10 That's 18% after four years, is that right?

11 A Yes.

12 Q Do you call that an
13 adequate cover?

14 A In combination with others
15 yes, it is. It fills a slightly different niche than
16 others, and/^{an}18% covering combination with 30% creeping
17 red fescue makes quite an adequate ground cover.

18 Q I'm sorry, would you
19 repeat that last statement?

20 A I don't know what I said,
21 but the point I was making, you use a mix of seed to
22 provide the variability, genetic variability to
23 accommodate the range of micro-habitat conditions on
24 a right-of-way from the moist depressions to the
25 drained elevated portions of the berm and if you
26 combine the 18% after four years with -- of the
27 Kentucky Blue with just 30% of the creeping red
28 fescue, you have an adequate ground cover.

29 Q Well, your creeping red
30 fescue had a 30% rate after four years at San Sault,

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams.

Cross-Exam by Hollingworth

1

2

is that right?

3

A Yes.

4

Q Are you adding that

5

cumulatively to the 18% from the Kentucky bluegrass?

6

A That's what I just did,

7

yes.

8

Q Is that a fair scientific

9

principle to use?

10

A I don't say it's a

11

scientific principle involved. You're adding the

12

combined production of the two and in actual fact

13

it's a seed mix. If the two were mixed together you

14

wouldn't necessarily get 48%, but you'd get better than

15

30 and you'd get the benefit of the Kentucky bluegrass

16

together with the creeping red.

17

Q Well then, do I understand

18

you to consider the percentages achieved at San Sault

19

after four years satisfactory on these varieties that

20

are listed?

21

A At that latitude, yes,

22

Q On all of them?

23

A Not on all, we haven't

24

proposed to use all of them necessarily.

25

Q Because sheep fescue has

26

gone up in its rate of cover in four years, but every

27

other variety listed there has gone down, hasn't it?

28

A That's what the dates

29

show.

30

Q All right.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1
2 THE COMMISSIONER: Well, do
3 you consider it satisfactory for your purposes which
4 is being principally to re-vegetate the right-of-way?

5 A Yes sir, we do, and it's
6 one thing to look at a bunch of numbers on a table
7 and it's quite a ~~another~~ to view the plots as established
8 after five years and the results obtained in these tests
9 we consider quite adequate for the purposes.

10 MR. HOLLINGWORTH: Q I'd like
11 to deal with your seed mixes for a while, Mr. Dabbs.
12 My understanding is that so far Arctic Gas has proposed
13 essentially three mixes. The first one contained in
14 the Environmental Report on the Canadian Line; the
15 second one contained in the Environmental Report on
16 the American Line; and the third one in Appendix "C",
17 which is what we have been considering here today and
18 yesterday.

19 A Yes.

20 Q Now, are you contemplating
21 any other changes in your mix?

22 A I think it's important to
23 go back to the application where there was a foot-note
24 to that specification that stated that these would
25 be changed and up-dated in the light of continuing
26 research if found to be necessary and I believe in
27 this appendix we have also stated that as this
28 research is continuing and new research is being
29 added, that it's reasonable to believe that there could
30 be some changes in the future in the light of new
experimental results.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Hollingworth

Q Do you know what these
changes are at this time?

A Certainly not until the
research is completed.

Q And are you going to be
filing any contemplated, or any proposed changes in the
future with the Inquiry?

A I'm sure we will.
Counsel could answer that.

MR. HOLLINGWORTH: I'd like to
have those proposals if they are advanced, Mr. Marshall.

MR. MARSHALL: If Arctic Gas
intends to change the seed mixes, that it intends to
use from what are presented in Appendix "C", you wish to
be advised?

MR. HOLLINGWORTH: That is
correct.

MR. MARSHALL: Yes, I think we
could do that.

MR. HOLLINGWORTH: Q Now I
understand in the boreal forest zone you plan to use
56 kilograms per hectare in high erodibility zone,
55 kilograms per hectare in a medium erodibility zone,
and 33 kilograms per hectare in a low erodibility zone.
Is that right?

A That's what those figures
add up to.

Q That's on Table 2.

A Yes.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Hollingworth

Q And in the forest tundra
zone for the high erodibility you would use 66 kilograms
per hectare; in the medium, 56, and in the low erodibility,
28.

A That's what it adds up
to.

Q Well, that seems to
indicate a pattern of decreasing amounts of seed as
you go from high erodibility to low erodibility, is
that right?

A That's right.

Q Well then, can you tell
me why in the low tundra zone you go from 56 kilograms
in high erodibility up to 58 kilograms per hectare
for medium erodibility, and then down to 28 in low
erodibility?

A I don't believe the
difference of two kilograms is significant here. I
would have to consult with Dr. Younkin as to why there
would be a minor discrepancy like that. It's not
important. The point is the decrease in rate of
application in a low erodibility area is a reflection
of the concern for erosion in those areas. It seems
unnecessary to maintain a rate of seeding in the range
of 56 kilograms per hectare on an area that has a very
low erosion potential. It's a simple matter of a light
seeding to promote the re-establishment of natives
on those areas, as in those cases you're not facing an
erosion problems.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

Q That's generally why you
have this pattern of decreasing amounts, isn't it,
because you don't have the erosion and the seed doesn't
disappear, it stays there, hopefully goes to seed.

A Yes.

Q But in this low tundra
zone you've got a rise, even though the erodibility
apparently decreases.

A We have a rise of two
kilograms, which as I said I don't believe is important.

Q O.K. now, what are the --
I notice that in the high and low erodibility zones
in low tundra, you're planning to use nugget Kentucky
blue; but then you're not going to use it in the
medium erodibility zone. Can you explain why?

A No, I can't. This combination
was prepared by Younkin and the rationale for his choice
in that particular case is not clear to me.

Q Well now, using thin
low tundra in the use of Arctared fescue, I notice that
in high erodibility you use 18 kilograms; in medium
erodibility zones, 40 kilograms; and in low erodibility
zones, 22 kilograms. Can you explain the reason for that?

A I'm sorry, I was still
concentrating on your earlier question and if we could
step back to that for a moment. Nugget Kentucky blue
is used in the followup seeding on medium erodibility
in low Arctic tundra facilities included.

Q Well how come it isn't

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Hollingworth

1
2 used the first time around?

3 A I don't have an answer
4 for that at this time, but I could provide you with it.

5 Q O.K. Well now then, I'll
6 repeat my question for you. I'm referring to the use of
7 Arctared fescue in a low tundra zone, and in high
8 erodibility zones it's used at the rate of 18 kilograms
9 per hectare; in medium erodibility zones, 40 kilograms
10 per hectare; and in low erodibility zones, at 22 kilo-
11 grams per hectare. Now, can you explain the reason for
12 that fluctuation?

Clark, Dabbs, Harlan, Fernstock
Koskimaki, McCart, Minning,
Williams
Cross-Fxam by Hollingworth

1 A You will notice the
2 difference between the high and the medium is only
3 two kilograms. The reason for that is not clear and
4 I do not believe--

5 Q Excuse me. The difference
6 between--

7 A The high and the medium,
8 38 and 40--oh sorry, I am looking at the wrong figures--

9 Q 18 and 40.

10 A 18 and 40. In the case of
11 the high erodibility, we are proposing to use mats
12 either seeded or the seed and mats separately. They
13 are only used in the higher erodibility areas. The
14 importance here is the combination of not only the
15 varieties named but the supplementary technique to
16 assist in erosion control whereas in medium erosion
17 potential we do not propose to use the seed mats. And
18 that combination has obviously influenced the selection
19 and rate proposed for application of the two species.

20 Q Okay now, looking at the
21 forest tundra zone, in the initial seeding in high
22 erodibility you use Arctared fescue, but in the
23 medium and low erodibility zones you use boreal red fescue.
24 Do you know why?

25 A Medium and low erodibility
26 are of lesser concern. In the forest tundra areas we
27 have found that the boreal creeping red fescue does
28 and will provide the required erosion control cover in
29 those areas. Arctared is somewhat more vigorous and
30 somewhat more adapted to the cooler northern areas.

1 proposed only for the high erosion areas. It is a much
2 more expensive seed than the boreal and is considered
3 unnecessary in the lower erosion potential areas.

4 Q Okay now, looking at
5 follow-up seedings. I do not know whether this might
6 be a typing error or what but the seeding mix for
7 the low tundra and forest tundra and follow-up is a
8 combination of Arctared fescue and Nugget Kentucky blue.
9 In high and medium erodibility zones of forest tundra
10 and in the high erodibility zone of low tundra, it is
11 in the proportion of 19 kilograms a hectare for Nugget
12 blue and 9 kilograms a hectare for Arctared fescue. But
13 in the fourth area using this mix is reversed so that it is
14 19 kilograms a hectare of Arctared fescue as opposed to
15 9 of Nugget blue. Why is that mix reversed or is that
16 possibly a typing error?

17 A I do not know why that is
18 reversed and if you wish I can get clarification on that.

19 Q Could you please and let
20 your counsel know?

21 A Yes.

22 Q In low erodibility zones
23 it seems there is not going to be any follow-up seeding.
24 Is that correct?

25 A It is not planned at this
26 time.

27 Q I see. Well, in the event
28 that you were not very successful with your vegetation
29 catch would you change those plans and go in and
understand that?

Clark, Dabbs, Farlan, Hemstock
Koshimaki, McCart, Minning,
Williams
Cross-Exam by Follinworth

1 A Yes, if field sur-
2 veillance would indicate the need for it, yes.

3 Q You are assuming for the
4 time being that it will be successful.

5 A We are assuming at the
6 time being that it is as it is low erosion potential
7 for these areas it may not be necessary.

8 Q Okay. Now turning to page
9 of appendix C. There is a discussion that has come
10 over from page 7 and 8 and the last sentence just before
11 paragraph 4.2 says,

12 "From these results, it would appear that the
13 addition of Timothy and other rapid growing species
14 to a seed mix and the improved color production
15 first year if it is not too high a proportion
16 can limit the establishment of the longer
17 lived species".

18 And that is the longevity of the mix. Is that right?

19 A That is what it says. Yes.

20 Q Okay now. Would you look
21 at table 2 again please? In the forest tundra region,
22 in the medium erodibility zone.

23 A Yes.

24 Q You have got 34 kilograms
25 per hectare of Timothy being applied out of a total of
26 56., 56 kilograms a hectare. Is that right?

27 A Right.

28 Q Now that is 61% of the
29 total mix for that area.

30 A That is quite right.

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1 Q Well, if your statement
2 on page 11 or page 9 is correct, aren't you going to be
3 inhibiting the growth of other species with this use
4 of Timothy?

5 A Not with 34 kilograms per
6 hectare. And that statement is consistent I believe
7 as the results plots such as the Gulf Mobile A01 site
8 in the Caribou Hills we are speaking there of a hundred
9 kilograms per hectare of Timothy and that relates to
10 that statement--34 is not considered excessive at all.

11 Q Well, presumably you
12 are applying 56 kilograms because you regard that as
13 adequate to provide a hundred per cent ground cover in
14 this area. Is that not right?

15 A Not a hundred per cent.
16 No, sir.

17 Q You do not want to achieve
18 a hundred per cent?

19 A No, that has never been
20 stated as an objective.

21 Q What do you want to
22 achieve then? Maximum ground cover?

23 A My own assessment of a
24 very successful re-vegetation program in an area
25 of medium erodibility would be in the order of 50 or
26 60% ground cover.

27 Q That is what you want to
28 achieve?

29 A That would be my idea of
30 a successful program. Yes.

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Hollingworth

1 Q Do you regard that as the
2 optimum?

3 A I suppose you can word
4 it that way. Yes.

5 Q Well, do or don't you.

6 A I am not certain what you
7 mean by the optimum.

8 Q Well, what is the most
9 desirable result ground coverage there is to achieve?

10 A In the range of 50 to
11 60%, as I said.

12 Q Thank you. Can you turn
13 to page 8 of the evidence Dr. Clark, please?

14 This, I realize is in the
15 re-vegetation portion of the evidence, but it is speaking
16 of the slopes and there is a figure there given in the
17 second complete paragraph that you would provide extra
18 treatment on slopes greater than 3%.

19 WITNESS CLARK: Yes.

20 Q Was this figure put forward
21 by your people or your geo-technical people or by Mr.
22 Dabbs?

23 A The 3% is in keeping with
24 our general assessment of slopes in that slopes of
25 less than 3% are generally considered to be stable.

26 Q And that is the basis for
27 the selection of this figure.

28 A Yes.

29 Q Well, do any other factors
30 affect erosion besides the slope?

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1 A Yes.

2 Q What are they?

3 A Soil type, the amount of
4 drainage, the catchment area, the climate, and so on
5 in this erosion rating of high and medium and low. There
6 are a number of these factors that have been taken into
7 account.

8 Q Don't you really have to
9 study each individual hill and weigh the factors that
10 affect it by itself?

11 A That is what I really
12 thought I was just saying. I would not classify it as
13 a study of each hill but certainly every slope has to
14 be considered relative to its own physical setting
15 and soil type.

16 Q Well, if you do study each
17 hill, what does this rule of thumb of 3% mean then?
18 What use is it to you?

19 A It should read degrees
20 but it does not make much difference.

21 Q I was wondering about that.

22 A What it means to us is
23 that, of the entire route, I believe it is less than
24 5% of the length exceeds the slopes in the direction of
25 the pipe, it exceeds 3 degrees.

26

27

28

29

30

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Hollingworth

Q Well, are slope failures
on hills 3 degrees or more encountered just in the
area you're speaking of, the area of the pipeline, or
in other areas as well?

A I'm sorry, I don't
understand the question.

Q Where do you get the
evidence to establish this 3 degree guideline?

A Oh, it's contained in
the literature, I believe observations by Strand, I
think that -- and others -- as well as our own
observations is generally slopes that are flatter
than 3 degrees can be considered stable almost irrespec-
tive of what we do to them.

Q Well, are you establishing
this 3 degree figure on the basis of literature
research, or on the basis of field research?

A It's both, there has been
over the past five years extensive field reconnaissance
and testing, test drilling and sampling of slopes,
and it was rather arbitrarily selected at the outset,
and we wanted to know just how much slope we had over
three degrees, so we had an analysis made using photo-
grametric methods.

Q So you presumably estab-
lished this rule of thumb of three degrees before you
had the analysis done of how many slopes were involved
that exceeded that figure?

A Yes, at that point in
time it was -- it had been observed by people, our

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1 consultants, and I believe by others, that slopes
2 less than three degrees were generally stable. Miss
3 Minning has pointed out in a reference here which is
4 "Studies of Vegetation, Land form and Permafrost
5 in the Mackenzie Valley,"
6 some case histories of disturbance by R.M. Strang,
7 Canadian Forestry Service, Environment Canada, it's
8 for the Environmental Social Program, Northern Pipelines,
9 it was published in August of 1973.

10 The critical angle of slope,
11 heading on page 25 says:

12 "The angle of slope at which accelerated erosion
13 becomes noticeable is between 5% and 10%, and so
14 for practical purposes 5% should be taken as the
15 critical limit."
16

17 So it's supported both by
18 our own observations and by other field workers, I
19 believe.

20 Q Well, are these -- is
21 this figure of 3 degrees used on slopes before their
22 failure or after their failure?

23 A I don't understand.
24 What do you mean "used on slopes"?

25 Q Well, when you look at
26 a hill, are you looking at one that hasn't failed when
27 you're saying, "That's less than three degrees and
28 therefore it's O.K."?

29 A Oh, there are cases where
30 unstable soil can exist at less than three degrees, and

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1 I believe this is pointed out in our report on slopes,
2 and particularly the frontal low bed section of a
3 bimodal its /^{flow} you may prefer to call them retrogressive
4 thaw flow. A tongue of soil comes out and it flows
5 at angles less than three degrees.
6

7 Q Well, that's a failed
8 slope, isn't it?

9 A That's a failed slope,
10 yes.

11 Q O.K., well can we turn
12 to page 11 of your testimony, and the first complete
13 paragraph of the last two sentences there, about two-
14 thirds of the way down the page it states:

15 "Similarly, gravel fill may be placed immediately
16 following pipe /^{laying} operations on slopes that
17 are potentially unstable on thawing. The
18 gravel fill significantly increases terrain
19 stability if degradation occurs following
20 removal of /^{the} forest cover."

21 What's the basis for
22 your comment that it increases terrain stability?

23 A Gravel fill?

24 Q M-hm.

25 A Analysis again, if you
26 recall back, Dr. Morgenstern presented here with the
27 geotechnical panel, some examples of stabilization
28 procedures; that was a theoretical analysis. He also
29 illustrated it with photographs of case histories both
30 along the Mackenzie Valley Highway and in Alaska.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1 Q Well, are these references
2 listed in the works that your panel is relying on in
3 giving this testimony?

4 A These references, I
5 believe, certainly have been listed
6 by our previous panel, if not by this one. One reference
7 is Morgenstern, Pfuhal, P-F-U-H-A-L, and a couple of
8 others. This was based on a reconnaissance of slopes
9 in the Northwest Territories, the Yukon and Alaska.
10 I believe that's also been published, the same
11 -- the Environmental & Social Program for Northern
12 Pipelines group.

13 Q Well, are you saying
14 that gravel fill helps to contain erosion or that it
15 helps the slope stability?

16 A It may do both. This
17 is -- I don't want to imply that every time we pass
18 a slope of more than three degrees that we coat it
19 with gravel. There are cut slopes and there are good
20 examples along the Mackenzie Highway now where you can
21 see this, where bimodal flows have been stabilized by
22 covering with gravel. It also prevents erosion,
23 obviously it's very erosive-resistant material. In
24 many cases we'd be using the gravel as part of the
25 sandwich construction that was illustrated with
26 insulative material as well; but the use of gravel on
27 slopes for stabilization and erosion control, I think
28 probably dates back to as long as people have been
29 concerned about stabilizing slopes. It's a very
30 technique.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1
2 Q Well, is this the
3 technique you're going to use throughout the pipeline
4 route?

5 A Oh no, no. We have laid
6 out the route to avoid anything that has appeared to
7 us to have been an unstable area, and I'm sure you're
8 familiar with the process there. If we found a slope
9 that we were led to believe that it was going to fail,
10 and that such failure could affect the pipeline or
11 could block a stream or create some kind of environmental
12 disturbance that was judged to be unacceptable, this is
13 one of the techniques that would be used. An example
14 that we gave in the application was a gravel stabilizing
15 berm for the Great Bear River, a crossing at that
16 time we proposed there.

17 Q O.K., suppose you found
18 a potentially unstable hill anywhere along the pipeline
19 route. Would you use this technique?

20 A No, not necessarily.
21 It would depend upon the reason for the instability.
22 If it was going to thaw and develop excess pore
23 pressures, we might deal directly with the excess pore
24 pressure, provide a means for relieving that by drains.
25 The probable greatest use of gravel for stabilizing
26 would be cut slopes.

27 Q Well, you're familiar
28 with the term "warmer permafrost areas"?

29 A Yes.

30 Q That's permafrost areas
around 31 degrees Fahrenheit or something?

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

A Yes.

Q Can this statement on
page 11 still be defended in those areas?

A For a cut slope, yes.

Q Just for cut slopes though?

A Probably just on cut
slopes.

Q Because isn't it true
that applying gravel can cause severe degradation in
those warmer permafrost areas?

A Well, the way we view
warmer permafrost areas is almost anything we do is
going to cause some degradation.

Q For instance, on the
Canol Road

A Yes, that's permafrost
there has completely degraded under the Canol Road,
but the comforting thing about that is that there has
been very little disturbance associated with it, very
little settlement. As we go south, ^{for instance} south of Simpson
I'm sure in certain areas where if we clear the trees,
that by itself is going to cause permafrost degradation.

Q And you're unlikely to
use this principle of placing gravel on a hill in those
warmer permafrost areas except on cut slopes. Is that
right?

A We would use it on cut
slopes, but I couldn't -- no, I couldn't see that as
being required there. It might -- I think we would

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1 | sooner drain the slope than retain it with gravel.

2 | Q O.K. Dr. Harlan, on
3 | page 14 of your evidence, paragraph 5.4.1, the second
4 | statement or second sentence rather makes the
5 | statement:
6 |

7 | "Whereas the ground over the pipe will freeze
8 | in winter, as will the rest of the active
9 | layer, the presence of the cold pipe will not
10 | prevent the development of an active layer in
11 | summer."

12 | Then you go on to repeat that, I think, on page 17 in
13 | the first sentence. Now if I can just turn that around
14 | a minute, is it your feeling that the active layer
15 | will develop in most cases in the summer over the pipe?
16 |

17 |

18 |

19 |

20 |

21 |

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Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1 WITNESS HARLAN: Yes, it will.

2 Q Then drainage wouldn't
3 be interrupted at all, or very much in the summer,
4 because you'd have that active layer.

5 A This is not to say that
6 the active layer over the pipe may not be higher than
7 over the remainder of the right-of-way.

8 Q That's what I'm getting
9 to, because really the issue here is whether the
10 active layer of flow is maintained, isn't it? If
11 you have an active layer, then you can have an active
12 layer of flow maintained and have drainage through it.

13 A Yes.

14 Q Won't the fact that the
15 active layer is higher over the berm affect drainage?

16 A Locally yes; overall
17 probably the effects will be very minor.

18 Q O.K., well if that active
19 layer of flow is maintained, have you considered the
20 effects of buoyancy in the pipe ditch during the
21 period prior to startup?

22 A I'm not sure I understand
23 the question.

24 Q Well, the freezing
25 associated with the cold gas going through the pipe,
26 will only start after startup of operation, isn't that
27 correct?

28 A That is correct

29 Q Now you're saying that
30 there's going to be an active layer with active flow

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Hollingworth

maintained above the pipe.

A Above the pipe. That's correct.

Q Now, isn't that going to affect -- have some affect on buoyancy in the ditch of the pipe?

A The buoyancy only becomes a problem if thaw progresses beneath the base of the pipe.

Q Well in fact the ditch will fill up with water, won't it, if the thaw goes below the pipe?

A Yes, it would.

Q And what would your --

A Our geothermal analysis indicate that under one or two inactive seasons, the depth of thaw will not penetrate beneath the base of the pipe.

WITNESS CLARK: That depends upon the location, for instance along the Arctic coast the analysis, plus the test site experience, indicates that the depth of thaw doesn't get below the pipe. Down around Simpson it would get below the pipe.

Q Well, Dr. Harlan, have you evidence that the granular backfill will be effective as a conductor of the active layer of flow? In other words, that the water won't freeze?

WITNESS HARLAN: This is during the summer?

Q Yes.

A I'm not sure I follow you

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Hollingworth

question.

Q I understand that the
backfill over the pipe could retain water from the
active layer of flow, and --

A It could contain water,
yes.

Q -- and essentially
prevent drainage through it.

A It depends what the
backfill material is.

Q All right, if it's
gravel --

A If it were gravel, it
would retain very little water and have very little
effect on inhibiting flow.

Q Well now, if the granular
backfill, if the water in the granular backfill froze,
and prevented drainage, prevented the active layer
flow, you're going to have upslope ponding, aren't you?

A Possibly locally. We're
not dealing with the plane. We're dealing with the
three-dimension or regular surface.

Q Yes.

A So if there is a tendency
for ponding in one location, our evidence indicates that
the water will ^{be} redistributed ^{up} upslope of the pipeline,
will move toward the lower depressional areas and in
these areas cross the pipeline.

Q And have you allowed for

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1
2 that possibility occurring?

3 A Allowed for it in what
4 sense?

5 Q Well, have you provided
6 drainage in the event that that does happen?

7 A Yes.

8 Q Because you speak of
9 mound breaks being provided at intervals, as well as
10 at natural drainages.

11 A That is correct.

12 Q And you have a table, I
13 think, in one of your Northern Engineering Reports, is
14 that not right?

15 A The report is the N.E.
16 Report on Drainage and Erosion Control Measures dated
17 March '75.

18 Q Yes.

19 A I'm referring specifically
20 to figure 12 on page 33.

21 Q Now do I understand that
22 your program is to go along and provide mound breaks
23 at natural drainage areas, but in addition to that
24 to put mound breaks at specific distances along the
25 pipeline, no matter where they are, in accordance with
26 this table?

27 A This table only gives an
28 indication of the types of mound breaks spacing.

29 Q You mean it's a guideline?

30 A Yes, it's a guideline.

Clark, Dabbs, Harlan, Hemstad, P.
Hollinger, Leach, M...
Williams
Cross-Exam by Hollingworth

go out and see where the drainages occur.

A Yes.

Q Because I notice that
in one case, at least, the table would provide mound
breaks at 2-mile intervals and I was just wondering
what use that was.

A I suppose it depends on
the situation, specific situation.

Q Do you mean you can fore-
see areas where a mound break every two miles is all
that's required?

A It's very difficult.

Q Pardon me?

A It's very difficult to
foresee areas where you'd have a 2-mile spacing.

Q Can you think of any area
along the pipeline where you would only need breaks
at 2-mile intervals?

A No. I should add that
this table is based upon rainfall runoff statistics
and from the hydraulic point of view that is the
spacing you would need for mound breaks to handle the
flow before it reached an erosive condition.

Q Well, I'm sort of led
to the conclusion that this table isn't really much
use.

WITNESS CLARK: I guess every-
thing depends on what you know about its application in
applying it.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Hollingworth

1

2

Q Are you making fun of

3

me, Dr. Clark?

4

A No, no, I could see your

5

problem, but you have to know what is the erosive

6

capacity of flow. The intermediate breaks, for

7

instance, are not at discreet drainage courses, would

8

be put in if we had assessed flow and found that it

9

was going to start eroding the backfill mound, rather

10

than to carry it on and have it increase as it gets

11

charged from other areas and go through the natural

12

drainage it would go through the intermediate break;

13

but that particular approach that Dr. Harlan has illus-

14

trated in this table is certainly not unique in

15

assessing erosion potential of various water flow, of

16

flowing water.

17

Q Well, I can see what you

18

want to put in intermediate mounds because you're

19

concerned about a flow going down the line of the mound

20

and causing erosion there. Is that essentially --

21

A Yes.

22

Q -- correct? Well, isn't

23

putting in these mound breaks going to cause erosion off

24

to the side of the pipeline right-of-way?

25

A It could if it wasn't

26

properly dispersed and controlled. There are two runoff

27

conditions, if you like, that are of concern. One is

28

the spring breakup when virtually it's all surface

29

flow and the ground is still frozen. Quite a bit of

30

water can run off in very short periods of time and

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Hollingworth

develop a very high erosive potential. Then there is the short intense summer rainstorm when perhaps the soil is saturated that you could also have quite a bit of runoff there. They are quite different. The erosion control measures have to accommodate both conditions.

Q On page 29, I think, Dr. Harlan, this will probably be yours, I wasn't here throughout Miss Minning's evidence in chief, the last sentence in the first complete paragraph says:

"Field data are also being obtained for the calibration and verification of the hydraulic module -- hydrologic modules, rather, proposed for optimization of the drainage and erosion control measures in river crossing design."

What locations are these field data being collected at?

WITNESS HARLAN: There are two sources of information. One, a series of hydrometric stations established by ourselves, and the second is a co-operative program with the Glaciology Division of the Inland Waters Directorate of Environment Canada. The location of our stations, we have two gauges on tributaries to the Firth River, we have four stream gauges in operation at Chick Lake on small drainages which vary in size from 600th of a square mile to 4/10ths of a square mile. We are also gauging the Donnelly River at its outlet at Chick Lake. This gauge is not used specifically for drainage control, and we are also gauging Vermilion Creek above this confluence with Nota Creek. The information we're obtaining from

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

the Glaciology Division is on Bonnyville Point. A
small stream ten miles south of Bonnyville Point,
Stony Creek, Jimmy Lake, Boot Creek, Peter Lake,
Cabins Creek, an unnamed stream south of Inuvik on the
Mackenzie Highway, an unnamed creek north of Fort Good
Hope, on Prohibition Creek, Hodgson Creek and Smith
Creek.

Clark, Dabbs, Harlan, Herstock
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollinworth

Q And what type of data
is being obtained?

A Both stream flow data.
This is summer measurement only and precipitation,
both amount and intensity.

Q And also on page 22, I
am not sure if this is for you, Dr. Harlan or Dr. Clark.
Page, paragraph 2, the last two sentences seems to
indicate that Arctic Gas is reconsidering the last point
of chilling the gas. Is that what I should infer from
that statement?

WITNESS CLARK: Yes, we have
also stated that in direct evidence before that we are,
we feel that there is a rational basis of optimizing this
point. It requires a lot of field information. We
come back to the point that we are satisfied with
where we are now. The choice ultimately would perhaps
be determined on an economic analysis as to whether it
is more economical to deal with thaw settlement
potential that may be there or frost heave. We feel
that where we are now, we are essentially out of the
thaw settlement problem.

Q What are the present
studies you have under way to determine this?

A We had an extensive
field program. There ^{are} several going on this summer. We
sampled frozen soils to assess thaw settlement. We
sampled unfrozen soils to assess frost heave potential.

• We did an analysis. Our
first step was to use our geologist, Miss Minning and

thawed or frozen. Then you have to have a further

is just not economical to put down holes every few

there. We picked nine different sites where Dr. Hoekstra

a few weeks ago and we have assessed this data and

information so we have currently another field program

On now, which we think will go a long ways towards defining the optimum point.

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

Q And what about--

A That is the general where
we are now working on it as well.

Q And the proposed one
would be in this same vicinity?

A The same general area, yes.

Q Are you contemplating--
Sorry, go ahead.

A There are quite a few
factors that go into this. There is the ice content
obviously, the distribution of the soils, the aerial
extent. There is the pipe-soil interaction considerations.
Once you are operating at a higher temperature, there is
potential for higher thermal stresses and less left
over for other other stresses, if you like. It depends
an awful lot on other features, slope stability for
instance. If there is a particular slope, take the
Mackenzie River crossing east of Simpson. We have that
instrumented now to determine if that slope would
remain stable if we were above freezing temperatures
there. That is a significant control point. Then
there is the Ebbutt Hills. Obviously if you are going
to have a chilled pipeline you want to be where the
ground is frozen and the analysis that we have done
over the Ebbutt Hills indicates that it is 90% frozen
so we obviously want to go south of that. But as I said
in an earlier--

Q Around the Ebbutt Hills?

A No, south.

Q South.

1 A We want to carry our
2 chilling south of that area.

3 Q I see.

4 A The next point of major
5 interest is the crossing east of Simpson. If that
6 slope will remain stable with warm gas, we may be better
7 off to move our last point of chilling to just north
8 of that river. I cannot see us going farther north
9 than that. So that is the area where we are concentrating
10 on now and I believe there is a rational basis you can
11 collect information and make a good decision on this.
12 And I think if one arbitrarily picks and says stop
13 chilling there, you could introduce all kinds of
14 problems. The other factor is cost. If you had a
15 frost settlement problem, it is unlikely that you would
16 want to bring the pipe out of the ground to support it
17 on piles and I do not see any alternative than to support
18 it on piles if it is going to settle excessively so you
19 would probably dig a ditch, put in piles and support
20 on those piles. And I think this is the same evidence
21 that your design panel presented as their approach.
22 We are on common ground, only yours is thawing and ours
23 is freezing.

24 But the cost of doing
25 that is about--the cost of the line on piles is about
26 two to three times higher, when you include the ditch
27 and so on, our assessment is that that would be three
28 times higher than the cost of a normal pipeline. When
29 you have to compare that to the cost of inhibiting
30 frost heave, and our analysis indicates that it is about

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Hollingworth

1 10 to 1. You would want--in other words, you could
2 inhibit frost heave with the upper limit of what we
3 would want to do, say 6 foot berm 45 feet wide. You
4 could do a hundred miles of that at the same cost that
5 you would do of 10 miles of thaw settlement. So
6 taking all these into consideration, we are going to be
7 able to arrive at a point and say this is the best
8 place to stop chilling and even there I am convinced
9 that there would be 50 to 100 miles where it won't make
10 too much difference.

11 Q This is essentially an
12 economic decision?

13 A Economics certainly has
14 to come into it but you cannot ignore what is going to
15 be happening to the right-of-way and the environmental
16 effects that it might have.

17 Q Okay, you mentioned some
18 mix--

19 THE COMMISSIONER: Excuse me,
20 Mr. Hollingworth, the only way to avoid thaw settlement,
21 I gather from what you say, is to elevate the pipeline.

22 A To support it on piles.

23 Q Yes?

24 A Or to reroute around
25 the area of the potential thaw settlement.

26 Q Well, whether
27 you build it on piles or reroute it around the area of
28 potential thaw settlement, do you say that your analysis
29 reveals that that is 10 times as costly as chilling to
30 avoid frost settlement and then coping with the frost

Clark, Dabbs, Harlan, Hems
Koskimaki, McCart, Minning
Williams
Cross-Exam by Hollingworth

1 heave.

2 A Yes, with the surcharge
3 method that we described.

4 Q
5 the berm.

6 A Yes, the berm to
7 this extent that we see it, not as to what Dr. Williams
8 saw.

9 I understand
10 we are not starting that argument today are we?

11 A Hopefully not.

12 That is not a rigorous
13 analysis but it is one that was based on an analysis
14 of above-ground pipeline. The cost came to 2 1/2 to
15 3 times as much. And then we have analyzed what
16 cost of a berm, the type of berm, the maximum type
17 berm that we would see.

18 Q
19 taking the pipeline as a whole, the cost of
20 a pipeline above ground or elevated or on piles
21 avoiding the areas of potential thaw settlement
22 2 1/2 to 3 times as much as the total cost of building
23 a buried chilled gas pipeline.

24 A That is my information,
25 MR. SCOTT: Mr. Commissioner,
26 just so I will understand when Dr. Clark gives his
27 figures, I take it he is not talking about concept of
28 an elevated pipeline. That is a pipeline above ground

29 A No.

30 Q You are talking about a

Clark, Dabbs, Harlan,
Koskimaki, McCart, Minnie
Williams
Cross-Exam by Hollinworth

1 pipeline supported but buried.

2 A In a ditch.

3 Q But supported on

4 yes.

5 MR. MARSHALL: Well,

6 me. I think there are three things being talked about

7 One was the cost of being elevated as opposed to

8 normal buried line. The cost penalty is 2 1/2 to

9 times the amount.

10 A That is right.

11 Q And if

12 have a buried line but because the frost settlement

13 problems, you have to have it supported on piles,

14 you are up to 10 times the cost.

15 A No.

16 Q Or do I h

17 it wrong?

18 A No, if you bury it a

19 support it on piles, I have said there will be

20 as much, 2 1/2 to 3 times as much if it is

21 ground and I have assumed that if it is in the ground

22 I have taken the upper limit of 3 because you still

23 to dig a ditch. But the cost of doing that, supportir

24 it on piles is 10 times as much as building a berm to

25 inhibit frost heave. That is where the 10 times

26 much came in.

27 THE COMMISSIONER: 3 times

28 much for the total pipeline, 10 times as much the

29 difference between the remedial
/ measures with respect

30 each condition.

Clark, Dabbs, Harlan, Hemst
Koskimaki, McCart, Minning
Williams
Cross-Exam by Hollingworth

1 A Yes. And that is not
2 rigorous analysis. It is all part of a type of a
3 figure, 8 to 10 times as much.
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Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Hollingworth

1
2 THE COMMISSIONER: You said --
3 excuse me, Mr. Hollingworth -- you said that you were
4 excluding an elevated pipeline just for -- that is
5 one built on elevated support members along the lines
6 of the Alaska oil pipeline. Are you talking about one
7 that is buried but supported on piles in the ditch?

8 A Yes.

9 MR. HOLLINGWORTH: There's been
10 some testimony on that before, I think it was one of
11 our panels.

12 A Yes, it was, both as
13 a mitigative measure that I think it was Mr. Mirosh
14 that testified that if the pipeline were settling, you
15 would go in and support it on piles, put in cross-
16 beams and so on, and that's the same type of thing that
17 we could foresee doing in that situation; but if by
18 saying we're burying in a ditch, what I'm saying, it
19 would be impractical to come along and then come up
20 over a potential high thaw settlement area and then back
21 down. It's a preferable approach, in my view, would
22 be to come in with a buried pipeline right through and
23 not introduce other problems of metallurgy and so on.

24 Q You mentioned in your
25 discussion on the field studies that you are using some
26 instruments at Fort Simpson.

27 A Yes.

28 Q What exactly are these
29 instruments?

30 A There are conventional

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Hollingworth

1 monitoring devices that are used in slopes. It's a
2 slope inclinometer where casings are put in the
3 ground and one runs down a device that tells you if
4 that casing is moving, and how much it's moved, and
5 the direction it's moved. There are also piezometers
6 to monitor pore pressure, and thermistors to measure
7 ground temperature.

8
9 Q Well, if these devices
10 moved, does that indicate to you the slope's failing?

11 A No, not necessarily.

12 Q What does it indicate?

13 A It could be creep, for
14 instance, a very slow down-slope movement. It all
15 would fall in the category of mass movement, as we've
16 heard described.

17 Q And what's the basis for
18 the selection of locations for these instruments?

19 A You mean the site, why
20 did we pick Fort Simpson?

21 Q No, why do you pick the
22 particular site you do, a hill?

23 A Why do we pick a hill?

24 Q Well, let's go back. I
25 understood you to say that these instruments were being
26 put in hillsides.

27 A Yes sir.

28 Q Now, why do you partic-
29 ularly pick a hillside to put them into?

30 A We picked two. The first

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Hollingworth

1 one was the Great Bear River because we assessed that
2 as to be probably the slope that had the greatest
3 potential for creep, and we thought if we can satisfy
4 ourselves there that creep is not occurring, we probably
5 would be happy with virtually all the slopes, and we
6 had a lot of discussion there with different people.
7 The G.S.C. has also funded some work along the Great
8 Bear River but there is a co-operative program going
9 on now, partly funded by CAGSL, G.S.C., and University
10 of Alberta. One of the graduate students is doing
11 a fair bit of work there.

12 Well then we extended this to
13 the east of Simpson because for the same reason, this
14 is a very significant slope and we wanted to see what's
15 happening to it, that's about it.

16 MR. HOLLINGWORTH: Sir, I
17 don't know if you wanted to break for coffee now? It's
18 a convenient time.

19 THE COMMISSIONER: That's fine.

20 (PROCEEDINGS ADJOURNED FOR FEW MINUTES)
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Williams
Cross-Exam by Hollingworth

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR. MARSHALL: Before my friend begins his cross-examination, again, I'd like to point out that Table 2 in Appendix "C" to the prepared evidence, ~~the~~ table in Dr. Younkin's report has a number of typographical errors in it. The table was the subject of much of the cross-examination of Mr. Hollingworth. Dr. Younkin is checking the table and we'll have a new table prepared with the corrections, and we'll have it handed out as soon as it's available.

MR. HOLLINGWORTH: Let it be known how short and brief I would have been but for that, sir.

THE COMMISSIONER: Well, you're through then, are you?

MR. HOLLINGWORTH: No such luck.

Q Perhaps someone could tell me who is responsible for 4.1 that's on page 6, "Route Selection"?

WITNESS HARLAN: I have Mr. Williams noted on my copy. It probably depends on the nature of the question.

Q Is that right, Mr. Williams?

WITNESS WILLIAMS: Well, let's give it a try, Mr. Hollingworth.

Q O.K., in the second sentence on page 6 you state in part:

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Koskimaki, McCart, Minning
Williams

Cross-Exam by Hollingworth

1 "Arctic Gas has undertaken and is continuing

2 to undertake studies aimed at route refinement."

3 I assume from that you mean changes in the geographical
4 location of the route.
5

6 A yes sir, minor changes.

7 Q What's a minor change,
8 by your definition?

9 A Oh, something that falls
10 within the window of the photomosaic as filed.

11 Q Which is a strip about
12 three miles wide, is it?

13 A Yes, almost three miles.

14 Q And do you have any present
15 changes contemplated from your filed route?

16 A We're certainly consider-
17 ing some, yes.

18 Q Which ones are you consider-
19 ing, is it a long list?

20 A Oh, it would be fairly
21 lengthy, yes, of the ones under consideration.

22 Q I'm sorry?

23 A Did you say "was it a
24 long list?"

25 Q Yes.

26 A I say yes, it would be
27 a fairly lengthy list.

28 Q And did I understand you
29 to go on and say there were about 100 changes you were
30 thinking of?

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Koskimaki, McCart, Minning
Williams
Cross-Exam by Hollingworth

A No sir.

Q Sorry, what was the last
part of your statement?

A It would be a fairly
lengthy list of the ones under consideration.

Q Well, approximately how
many changes are you considering at this time, do you
know?

A Oh, I think it's
substantially less than 100, maybe something like 20.

Q Are they in any particular
general area, or are they all up and down the line?

A They're fairly widespread.

Q Well, could you provide a
list of them to me?

MR. SCOTT: Surely Mr. Marshall
can undertake to let Foothills know as early as possible
where the route will go.

MR. HOLLINGWORTH: I was just
about to ask for that, Mr. Scott.

MR. SCOTT: So you can make any
changes in your own alignment sheets.

WITNESS WILLIAMS: We haven't
made any decisions on these modifications that are
being considered. They are just under consideration.

MR. HOLLINGWORTH: Well, could
you provide me with a list of the ones under consider-
ation?

A Sometime, not immediately.

Q No, I'm not asking for

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Hollingworth

1 immediately, through your counsel.

2 MR. MARSHALL: Well, I think,
3 if
4 Mr. Hollingworth, if changes are made you'll be, not the
5 first, among the first, among the first to know. If
6 the question is raised in one of the engineer's minds
7 about a possible change and they're just thinking about
8 it, they haven't really got to the point of doing any
9 sort of an assessment, knowing whether or not
10 there ought to be a change or there ought not to be
11 a change, it seems to me it just confuses the whole
12 issue.

13 MR. HOLLINGWORTH: Well, let
14 me ask this:

15 Q Have your advisors
16 recommended any changes from your existing alignment,
17 Mr. Williams?

18 A Well, this is a group
19 effort. Some people are recommending changes; some may
20 not agree with those recommendations. It has to be
21 a group effort of geotechnical, environmental, engineers
22 -- route location engineers, that is, and so forth.
23 These decisions certainly can't be made overnight or
24 even in a month or --

25 Q I'm not suggesting they
26 do be made overnight. I'm asking if your advisors have
27 recommended any changes, as of this date?

28 WITNESS CLARK: Perhaps I
29 could help a bit, here, because last April we said in
30 evidence, geotechnical evidence, that with respect to

Clark, Dabbs, Harlan, Hemstock
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Williams

Cross-Exam by Hollingworth

1 river crossings I think we used the figure about 8 to
2 12 that were under consideration, and I think more
3 precisely the figure is 10. We did give you examples
4

5 at that time, one of which was the Great Bear River
6 that was under consideration. We cited it as an example
7 of a fairly extensive move of more than 1,000 feet. Most
8 of the others were a few hundred feet. Now this last
9 summer there was a ^{fairly} detailed reconnaissance of all the
10 rivers by an inter-disciplinary group and they looked
11 at the ones that were under consideration and confirmed
12 in some cases, said, "Yes, we want to move that a
13 few hundred feet," in other cases satisfied themselves
14 that it didn't need moving. So of those changes that
15 Mr. Williams refers to, 10 of them would be at river
16 crossings.

17 Q But there are still ten
18 others.

19 A I think he just said
20 approximately 20, I don't know what those ten others
21 might be.

22 Q Well, I'm asking for a
23 list of them. I take it my friend is objecting?

24 WITNESS WILLIAMS: These
25 proposed changes I don't think, have been considered
26 by the environmental group at all. They wouldn't be
27 until the geotechnical route location people have made
28 a decision on their own. Then it would go to the
29 environmental group for comment, and further suggestive
30 revisions. This process is not that far along.

Clark, Dabbs, Harlan, Hemstock
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Williams
Cross-Exam by Hollingworth

1
2 Q Well, could I have a
3 list of those ten? Those ten rivers.

4 WITNESS CLARK: Those ten
5 rivers?

6 Q No, the other 10 apart from
7 the rivers.

8

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Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams

Cross-Exam by Hollingworth

MR. MARSHALL: Well, sir,

I think that as Mr. Williams said, the process is just under way, they haven't got the comments in from all the disciplines that like to look at these things, and it might be more useful to wait until N.E.S. has made up its mind as to whether or not it wants to recommend to Arctic Gas that there ought to be some revisions. If not, wait until Arctic Gas has decided whether or not it wants to have those revisions made. But at this stage it's more in the nature of ideas, and recommendations from one of the many disciplines involved. I think it just confuses the whole issue.

MR. ANTHONY: Mr. Commissioner, I wonder if I might interject for a moment, because we too would be interested in following up recommendations from the environmental consultants and advisors to Arctic Gas for particular route changes. Now we recognize that the geotechnical people and the cost people and a lot of other people have to consider these recommendations before any route changes actually is put forward by Arctic Gas; but I think that if there are particular route changes at particular locations where the environmental advisors are suggesting route changes, even though these have not been approved by Arctic Gas I think that information would be valuable, and particularly as we get into the consideration of Phase 3 evidence, and if that's what my friend is after, I would support him in that request and think that that would be within the powers of counsel to provide.

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Williams
Cross-Exam by Hollingworth

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MR. HOLLINGWORTH: That's exactly the sort of thing I'm after, Mr. Commissioner. My friend Mr. Marshall, and Mr. Scott for that matter, made particular emphasis when the Foothills location panel was on, that there were so many locations under consideration and asked for and in some cases has obtained, and is going to obtain detailed lists of those changes. The point being made seemed to be that Foothills was in such a preparatory stage that it didn't have its location down. Now we have evidence that Arctic Gas has 20 locations where it's considering changes, and I'm merely asking for the same list.

MR. SCOTT: Well, Mr. Commissioner, whether there are 20 or whether that is an estimate, we don't really know; but it seems to me it might be desirable to have a list of where these are proposed for another reason. That is if they are seriously being considered at this stage and can be considered by us as we proceed, we will ultimately save time in the long run because in the event that one of them should ultimately be selected, we won't have to go back and re-trace our steps and our analysis. So I would hope that perhaps as Foothills is going to do, I don't think they've done it yet, Arctic Gas might do the same, and indeed I think on an earlier occasion Arctic Gas indicated that if there were any reasonably substantial changes that were being contemplated, that they would undertake to let the Inquiry know as soon as possible. I think that was done, in fact, on the routing

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Williams
Cross-Exam by Hollingworth

1
2 panel.

3 MR. MARSHALL: Mr. Scott is
4 right about that point and we agreed that we would
5 advise the Inquiry. I just don't think we're at that
6 point with these items that Mr. Williams is talking
7 about. They haven't been looked at by all the people
8 within N.E.S. who want to look at them and make
9 recommendations, and N.E.S. hasn't got to the point
10 of making recommendations to Arctic Gas yet.

11 THE COMMISSIONER: As Mr.
12 Marshall says, how deeply can this Inquiry probe into
13 the individual minds of engineers at N.E.S. or into
14 the collective mind of N.E.S. until something becomes
15 a proposition that they reduce to writing and are
16 considering in a most serious way? If it's recommended
17 to Arctic Gas, well that's fine. I don't think anyone
18 would argue that that shouldn't be brought to the
19 Inquiry; but until it reaches that stage aren't we
20 perhaps imposing a greater obligation on these gentle-
21 men from N.E.S., the ladies and gentlemen from N.E.S.
22 than we should be?

23 MR. SCOTT: Well, Mr. Commis-
24 sioner, only two things:

25 (1) we've already done that in a major respect in
26 order to save time and proceed quickly; the cross-
27 delta route is not a route change as such, but yet
28 Arctic Gas has seen fit to tell us about that
29 and about -- in order that there will be full
30 disclosure and examination of it can take place

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as we proceed.

Now, obviously --

THE COMMISSIONER: Well, excuse me, Mr. Scott. Arctic Gas has done that out of presumably a certain amount of prudence. You see, Arctic Gas told this Inquiry at the Preliminary Hearings in April and May, 1974, that it had chosen its route and was ready to proceed with the building of this pipeline. Then we realized perhaps even then, but certainly later on that they might not want to take the route they had applied for -- this is a fundamental route change across the delta -- and they still apparently haven't decided whether they want to take that route, but they know that if they hadn't revealed the proposed route change to the Inquiry they would have been in trouble with the Inquiry. You can't come before the Inquiry in May, 1974, and say, "We've chosen our route and are ready to go." And then come before us in January, 1976 and say, "We've changed our minds and want to take it across the Mackenzie Delta."

MR. SCOTT: Well, Mr. Commissioner, first of all there are a number of cases. The cross-Delta is obviously a change of substantial proportions and now I take it we're talking about changes of the type that Dr. Clark referred to, changes at the point at which the pipe will cross a river or some such. That's point 1.

Point 2, I recognize, as I'm sure everybody does, that you know, every engineer who

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comes to work with Northern Engineering Services, who doesn't have a bright idea about a desirable route change every day is going to be in some kind of trouble. That's what they're there for, and obviously we don't want that kind of list. We want a list that represents some general engineering consensus, as it develops, even if it hasn't been vetted by the environmental people as Mr. Williams suggests.

The third observation is that it doesn't occur to me that a minor route change is necessarily less significant than a substantial one. For example, a minor route change at Fort Good Hope cannot be perceived to be less substantial vis a vis the people who live in that area, than a route change across the delta. All I'm saying, and it will have to be a judgment call that Arctic Gas will have to make itself, if and when they develop serious route changes, no matter how minor they may be in terms of the entire length of the pipe, those should be disclosed because if they are not, as I 'm sure Arctic Gas recognizes, they may have to be reviewed at a later date and delay will be caused.

Now Foothills has undertaken to do that. I emphasize "undertaken" because we haven't had their list yet. But surely Arctic Gas can make a judgment as to which are serious and which are merely momentary brainwaves that won't survive.

MR. AUTHORITY: Mr. Commissioner,
the only thing I would add to that is while I think

Clark, Dabbs, Harlan, Hemstock
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Cross-Exam by Hollingworth

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2 that agreement may have been, or we may have discussed
3 that with respect to the engineering consensus of
4 proposed route changes, what I am anxious to ensure is
5 that when there is a route change proposed for environ-
6 mental reasons as a result of an environmental consen-
7 sus, that the route should not go in this particular
8 area, that before it gets through the engineers at
9 Northern Engineering Services and ultimately up to
10 Arctic Gas, that we be advised of that. We propose
11 in Phase 3 to ask the environmental consultants about
12 areas and why they haven't suggested you go around
13 here or whatever the case may be.

14 Now if in fact they have been
15 doing that, there has been a consensus of all by the
16 environmental consultants on those particular changes,
17 I think it would shorten certainly our cross-examination
18 and would assist the Inquiry if that information was
19 made known. So I think we're talking about the same
20 level of preparedness, if you want, but I want to ensure
21 that we don't have to convince the engineers before
22 we ever find out about it at the Inquiry.

23 THE COMMISSIONER: Well, Mr.
24 Scott suggests that you should make a list available
25 of proposed route changes and the route changes that
26 should be included in that list should be those which
27 have achieved the support of a consensus of engineer-
28 ing opinion in N.E.S. Now that apparently is what
29 Foothills has agreed to do.

30 Mr. Anthony adds a gloss to

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
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Cross-Exam by Hollingworth

1
2 that and says that he would like -- at least I think
3 I understand this is what he's getting at -- he would
4 like you to advise regarding the recommendations of
5 the environmentalists with respect to each of those
6 proposed changes, that is your environmen_talists'
7 recommendations. Assuming that I've got that right,
8 is that something you're prepared to do, Mr. Marshall?
9 Or do you want to save it?

10 MR. MARSHALLL: I would like to
11 check further with Mr. Williams and have him get some
12 additional details, and perhaps we could discuss this
13 tomorrow.

14 MR. HOLLINGWORTH: Could we
15 speak to it tomorrow after lunch, sir? There are a
16 couple of points I'd like to check as well, sir.

17 THE COMMISSIONER: O.K.
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Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams

Cross - Exam. by Hollingworth

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2 MR. HOLLINGWORTH: Q On page 45
3 of the evidence I would assume there is a discussion of
4 the borrow operations at the bottom of the page.

WITNESS MINNING:

5 A I think I can speak to that.
6 Maybe Dr. McCart would like to speak to this too.

7 Q Well, you have got some active
8 flood plains on which you are going to conduct borrow
9 operations, as I understand it and you are going to
10 berms around those operations, is that right?

11 A This is the present plan, yes.
12 These flood plains we used only on the coastal route.
13 There are no flood plain deposits on the main route in
14 that area that you asked about yesterday.

15 Q All right, thank you for that
16 answer. Well, now, on the coastal route have you coll-
17 ected flood data on the rivers involved, where these
18 operations will be carried on?

19 A No borrow will be removed
20 from the active river channels.

21 Q I am talking about the active
22 flood plains. You are taking borrow--

23 A The water running on the active
24 flood plain that I am talking about. You are talking
25 about the channels.

26 Q As I understand your definition
27 of an active flood plain, that is an area that is flooded
28 during run off in the spring, or during flood situations,
29 but is not normally part of the active channel? A. That
30 is correct.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross - Exam. by Hollingworth

Q Well, have you conducted collected flood data on the rivers where you are conducting borrow operations?

WITNESS HARLAN: Yes, we have.
The collection of flood data for these rivers is mainly related to the River Engineering aspects of the river crossing designs..

Q Are you confident that these berms will stand up to a flood?

A Yes, we are.

Q You have made specific studies to establish that that will in fact occur?

A These studies are in the process of being carried out. Okay they are connected with the River Crossing Design, also with the Hydrologic Studies, which provide supplementary information on the flood frequency distributions for these articles of the rivers.

Q When will these reports be ready?

A Mid '76.

Q Do you have reports to show that the borrow pits will be cleansed during the spring floods after the berms have been broken open?

WITNESS CLARK:

A Do we have reports that indicate that?

Q Yes.

A The only report that we have is the observations that were made on the Alyeska route

1
2 and that was during construction. It is intended to have
3 a follow-up on that. The other is the observations that
4 Dr. McCart made yesterday on his work, the Kavik River.

5 Q So it's visual observation that
6 you are relying upon, using this theory?

7 A Yes. The assessment of the
8 effects on the river regime is based on a river
9 engineering analysis.

10 Q Could you turn to page 50. the
11 first sentence of the last paragraph. Dr. Harlan. I
12 imagine this is your area. You are talking about the use
13 of insulated sub-surface drains to maintain drainage?

WITNESS HARLAN:

14 A Yes, sir.

15 Q Now, do you have any other
16 measures in mind besides those?

17 A The two primary ones under
18 consideration are the use of the insulated sub-surface
19 drains and the second is insulation around the pipeline.

20 Q That was going to be my next
21 question. You are considering that as well?

22 A Yes. we are.

23 Q Would that be in addition to
24 insulated drains, or in substitution for?

25 A Probably in substitution for

26 Q I take it from that that you
27 consider the possibility that the drains might freeze
28 even if they are insulated?

29 A Our calculations show that the
30 use of an insulated drain requires a very great increase

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Clark, Dabbs, Harler, Herstein
Loskinen, McCart, Winnick,
Williams
Cross - Exam by Hollingsworth

of flow to maintain it in an open condition.

A: That's correct.

re-vegetation aspects on page 10 at 2.4, the cracks . .

I am not sure who is responsible for this area. I think
if you could give me figures on how you arrive at whether
area is high, medium or low erodibility?

Clark, Dabbs, Harlan, Norris,
Koskimaki, McCart, Minnema,
Williams.

Cross - Exam by Hollingworth

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2 soil conditions. It depends on the condition of the soil.
3 whether it is frozen, unfrozen. It also depends on the
4 amount of bonding there is due to roots, the root-growth,
5 root development. It depends on the slopes, the length
6 of the slopes, the climatic region, the configuration of
7 the ditch that we are concerned with, the interception of
8 flow and flow along the ditch and also the nature of the
9 material on that ditch.

10 Okay. there are some very obvious
11 areas. For example; a steep slope is of high erodibility
12 potential, whereas a flat area may be of low potential.
13 We have it defined precisely where the division between
14 high and medium erosion rating, or between medium and low.

15 Q Would you consider ice content
16 another factor to be considered?

17 A It's a soil condition, yes.

18 Q Okay. What about the drainage
19 classes of dry, moist and wet? Can you put figures on
20 those for me? Can you be more precise?

21 WITNESS DABBS. Those classes, dry
22 moist and wet are figures or are classes used in the origi-
23 nal set of specifications filed with the application and
24 they have subsequently been replaced with the erodibility
25 rating which takes into account the soil moisture condi-
26 tions such as mean intensity of precipitation
27 events, mean duration of these events, mean annual number
28 of precipitation events and to answer you question spec-
29 ifically, I don't have quantitative figures to define
30 one from the other, because we have more than one

Clark, [redacted] Harlan, Homestead
 Voskinali, McCart, [redacted]
 Williams.
 Cross - Exam by Follinworth

integrated program with geo-technical.

Q Well, it is really a [redacted]
 rather than a numerical figure or basis [redacted] [redacted]
 using to define these areas?

A Initially that's correct. [redacted]
 could probably be given, but of course that is out
 date and unnecessary.

Q If we could go back to [redacted]
 lastly to drainage through the round breaks. I guess
 this is a question for Dr. Clark. I am reading a March,
 1975 document, prepared by Northern Engineering called
 Drainage and Erosion Control Measures. Description and
 Proposed Design Principles. Are you familiar with that
 document?

WITNESS CALL [redacted]

Q Do you have it with you?

A Yes.

Q Could you turn to page 1 of
 Appendix 3?

A I don't recognize the cover or
 the report you are holding?

Q This is just a hardy
 cover that was around.

A Yes.

Q I think full credit is given
 to Northern Engineering on the front of the cover. Is that
 provides you with any comfort, Dr. Clark. There is a
 statement there, about halfway down saying,

Clark, Dabbs, Harlan, Herstock,
Koskimaki, McCart, Minning,
Williams.

Cross - Exam by Hollingworth

1
2 be determined by geo-thermal or
3 buoyancy considerations. but for
4 the purposes of this exercise it
5 is assumed that the levels of
6 scour must not exceed two point
7 five feet, the present level of
8 minimum cover."

9 Do you see that?

10 A Yes.

11 Q And I take it you concur with
12 that statement?

13 A Our criteria for berm breaks
14 that we presented before, the criteria for breaks in
15 the mound in
16 a frost-heaving situation. We have said that the heave
17 has to be limited to an amount such that you would at
18 least have one foot of cover if the break were maintained
19 at the same level as the soil was heaving.

20 In other words, the pipe would always
21 have to be at least one foot below where the original
22 ground surface was, so in that context it is not quite
23 the same at this.

24 Q Well, if we put aside frost-heave
25 though, I take it, you are in agreement with that statement?

26 A Yes.

27 Q I wasn't really considering a
28 frostheave application.

29 A We are talking about the
30 same thing, but the numbers are different in that case.
That is what I wanted to point out to you.

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Hollingworth

1
2 Q Well, isn't that a
3 regime scour method that's used for river situations?
4 Isn't that where that principle came from?

5 WITNESS HARLAN: It is
6 related to regime theory, yes.

7 Q And it came from a book
8 of Blench's, I think, didn't it?

9 A Yes, that's correct.

10 Q Well, do you agree with
11 the use of this method in designing mound breaks?

12 WITNESS CLARK: I think that
13 the point that's being made there, that if there is
14 sufficient flow that there would be significant scour,
15 we wouldn't use a typical mound break configuration,
16 it would be an actual design as if it were a minor
17 stream crossing.

18 Q Well, do you think that
19 the mound break should be allowed to scour at all?

20 A I would say that our
21 objective would be not to have scour there because
22 it might present a maintenance problem. I think
23 there will be scour at the mound breaks irrespective
24 of how carefully it's done and designed; there will be
25 maintenance required of mound breaks, drainage and
26 erosion control measures, particularly the first few
27 years.

28 MR. HOLLINGWORTH: O.K., thanks.
29 Those are all the questions I have.

30 MR. ANTHONY: Mr. Commissioner,

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

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2 as this is the first environmental panel by Arctic
3 Gas, I can't let the occasion pass without noting
4 that Les Williams has returned again, this time as
5 an environmentalist, and I trust the conversion is
6 therefore complete.

7 MR. SCOTT: I think he thought
8 he was an environmentalist from the very beginning.

9 WITNESS WILLIAMS: Right.

10 MR. ANTHONY: It's going to be
11 a long hearing.

12 THE COMMISSIONER: Keep all
13 your answers that short.

14
15 CROSS-EXAMINATION BY MR. ANTHONY:

16 Q I wonder if I could start
17 by directing your attention to the land requirement
18 comments made in your evidence in chief, in particular
19 your conclusions which are found on page 10, which
20 basically says that:

21 "Given the vast land area of the Territories,
22 your land requirement impact is not significant."
23 I take that what you're saying there is really the
24 old thread across the football field argument.

25 Mr. Hemstock, as the chief
26 environmental consultant, I would take it you would
27 agree with me that the percentage of total land mass
28 is not a very useful method of calculating impact by
29 itself.

30 WITNESS HEMSTOCK: No sir, it'

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1 just one of the factors.

2 Q And that some areas
3 obviously are more significant to the living environment
4 and to the people than other areas.

5 A Yes.

6 Q And that if you take the
7 areas of greater significance to the people and to the
8 critical habitat, that your 42.5 square miles could
9 in fact have a very significant impact.

10 A Well, I think that even
11 in relation to the smaller area which is important for
12 the people who live along the pipeline, that the pro-
13 portion is still very small, but I would agree that
14 it would be certainly more than when you compare it
15 to the total area of the north.

16 Q In fact, you would agree
17 that you must identify these areas of critical signi-
18 ficance before you can come to any conclusions about
19 environmen_tal impact.

20 A Yes, that's correct.

21 Q So in fact you -- do you
22 agree with me then that you would have to have some form
23 of a land classification or an understanding of signifi-
24 cant areas before you can come to these sorts of
25 conclusions?

26 A Yes.

27 Q And do I understand that
28 you have done this?

29 A Yes, we believe we've
30 done this.

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 Q And what are you relying
3 on to establish this land classification that you agree
4 is necessary?

5 A This will be dealt with
6 in panel 3, and we're relying on such things as habitat
7 surveys, populations of wildlife species and so on.

8 Q Dealing solely with the
9 issues of terrain, for example, have you received
10 reports from Parks Canada or I.B.P. people and so on
11 about particular areas of sensitive terrain?

12 A We are aware of the I.B.P.
13 sites. I don't know that they are properly described
14 as particular areas of sensitive terrain.

15 Q Well, other than the
16 I.B.P. sites, have you received any information from
17 the Government of Canada for example, to advise you
18 of areas of particular terrain sensitivity that you
19 should avoid?

20 A Yes, there are reports
21 from the environmental social program which we have,
22 of course, the Geological Survey of Canada Reports.

MR. MARSHALL:

23 I'm sorry, it's just not
24 clear to me what you mean by "sensitive terrain."
25 Are you talking about it in a sort of geotechnical
26 sense, as I believe Mr. Drew of one of the Foothills
27 panels was, or is it some other definition?

28 M R. ANTHONY: No, I'm dealing
29 with it in -- not necessarily in a strictly geotechnical
30 sense, though I am dealing with areas of terrain

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1 sensitivity and areas of critical terrain that are
2 obviously concerned with this panel as environmental
3 consultants dealing with the physical environment.
4 I'm just enquiring what information you got from for
5 example the Government of Canada as to areas that you
6 should avoid in pipeline construction.

7 A Well, I think those are the
8 reports that I mentioned, the G.S.C. Reports, terrain
9 sensitivity, the reports of the Social Environment
10 Committee, our own reports of course on the same -- of
11 the same general concerns.

12 Q Have you received any
13 information from government identifying areas designated
14 as wilderness areas, forest preserves, or other
15 particular terrain areas which should be avoided?

16 A We have information of
17 the proposed extension of the Wildlife Range in the
18 Yukon, the Northern Yukon. We have some information--
19 and I can't recall the details -- of the proposal for
20 a special area in the Firth River vicinity in the
21 Northern Yukon which I believe is larger than an
22 I.B.P. site, and I don't have the details of that.
23 I think those are all that we have.

24 Q As environmental advisors
25 to Arctic Gas, one of your functions is to select
26 environmentally the best route, and I imagine that
27 included in that is the selection of the best terrain
28 conditions, the best physical environment considerations
29 I believe that in your earlier evidence at Whitehorse
30 in dealing with the route from Prudhoe Bay your advice

Clark, Dabbs, Harlan, Hemstock
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Williams
Cross-Exam by Anthony

1 was that on basic -- on the basis of physical environ-
2 ment considerations the prime route overall is a better
3 route than the interior route. Is that --

4 A That's correct.

5 Q That's your -- that's
6 the opinion of you and the other environmental advisors
7 in comparing those two routes?

8 A On the --

9 MR. SCOTT: May I interrupt
10 my friend? When Dr. Hemstock said, "That's right," was
11 he answering all parts of that question? The first
12 part, that it was the function of the environmentalists
13 to select the best possible route, that was stated
14 by Mr. Anthony as a preamble; did Dr. Hemstock agree
15 with that? I don't understand. It's not, of course,
16 Dr. Hemstock's fault, it seemed to me that there were
17 too many questions wrapped up in that one to be sure
18 what Dr. Hemstock was answering.

19 MR. ANTHONY: Well then --

20 THE COMMISSIONER: Excuse me,
21 when you said, "That's right," what did you mean,
22 Dr. Hemstock? ^{Let's} Take it from there.

23 A I meant that the factors
24 which were outlined were a part of the equation which
25 you have in selecting a route. They were considera-
26 tions in the selection of a route.

27 MR. ANTHONY: Q So the
28 best terrain conditions were one of the considerations
29 you took in your advice to Arctic Gas?
30

Clark, Dabbs, Harlan, Hemstock
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Williams
Cross-Exam by Anthony

A Yes.

Q And taking those considera-
tions now, you came to the conclusion that the prime
route was a better route than the interior route.

Clark, Dabbs, Harlan, Herstock
Koskimaki, McCart, Minning,
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Cross-Exam by Anthony

1 A Yes.

2 Q Now, following your last
3 attendance here at Whitehorse, we had Dr. Hughes gave
4 evidence. I am sure you have had a chance to look at
5 that evidence where he suggested that from a terrain
6 point of view that there were greater advantages in
7 going thru the southern Yukon than going along either
8 the prime or the interior route. Would you agree with
9 his conclusion?

10 A On a unit basis the
11 terrain conditions are probably better in the southern
12 Yukon, but the point that I think is important is that
13 there are some 950 miles more right away required. And
14 that obviously is another factor that has to be con-
15 sidered in route selection, is the length of the route.

16 Q In terms of physical
17 impact on the environment though you would, if you want
18 to do it on a mile by mile assessment as you suggest,
19 you would agree with his general conclusions that
20 that Fairbanks route is preferable to the prime route.

21 A No.

22 Q Well, dealing now with--
23 I believe you have agreed that the terrain conditions
24 along the Fairbank route are preferable to the terrain
25 conditions along the north slope.

26 A The terrain conditions
27 in southern Yukon are easier than the terrain conditions
28 for pipelaying than across the north slope. Yes.

29 Q And would anticipate
30 therefore that the environmental impact of the pipeline

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Clark, Dabbs, Farlan, Herstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Anthony

1 environment would be less in those terrain conditions
2 rather than the terrain conditions you experience in
3 the north slope?

4 A No, I think not, because
5 the important factor is that with the methodology which
6 has been described here, we are capable of building
7 a pipeline across the north slope without causing us
8 great concern so that again you get back to the
9 environmental impact in total would be less on that
10 route than on the very much longer route which we call
11 the Fairbanks route.

12 Q And that is because the
13 route is longer?

14 A And because we see no
15 great difficulty in building across the north slope.
16 There certainly are concerns but they have been
17 studied and we believe we have mitigative measures
18 which will take care of those concerns.

19 Q So your advice to Arctic
20 Gas is that the environmental impact of constructing
21 a route on the north slope is less than the environmental
22 impact of any other location. It is the best route.

23 A That is the best route.

24 Q Strictly environmental
25 terms, strictly impact on the physical environment.

26 A Yes.

27 MR. MARSHALL: That does not
28 mean to suggest that his opinion on the living environ-
29 ment would be different than that but we are just
30 here today dealing with the physical environment

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Cross-Exam by Anthony

1 I take it Mr. Anthony.

2 MR. ANTHONY: Right. I
3 appreciate that and I will be getting into other ques-
4 tions on other environment impacts.

5 THE COMMISSIONER: Caribou are not
6 included in this equation.

7 MR. ANTHONY: Right. We are
8 dealing now solely with the question of physical impact
9 or impact on the physical environment and I wanted to
10 be sure I understood the advice that Arctic Gas is
11 getting from its environmental consultants as distinct
12 from the geo-technical people and other people that we
13 have talked about and heard from up to this time.

14 Subsequent to last time
15 we talked to you, we also had Dr. Rutter and Dr. Boer
16 describe the terrain of conditions east of the Franklin
17 Mountains as compared to the terrain conditions within
18 the Mackenzie Valley prime route, and their conclusions
19 were that the, from the terrain point of view, the
20 terrain was superior east of the Franklins for pipeline
21 construction than in the Mackenzie Valley. Their advice
22 also was that as far as overall length was concerned
23 they would be about the same. Now do you agree with
24 the conclusions that from a terrain point of view that
25 the terrain on the east side of the Franklin Mountains
26 is superior to the terrain along the prime route down
27 the Mackenzie Valley?

28 WITNESS HEMSTOCK: I do not
29 have detailed information on the other two routes. On
30 the basis of their testimony I would agree that I

Clark, Dabbs, Harlan, Herstock
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Anthony

1 would appear that there would be some preference or
2 some better terrain on the routes they suggested.

3 Q Now, you have indicated
4 that the question of route selection is one of the
5 mitigative measures that you rely on in dealing with
6 physical or impact on physical environment. Have you
7 recommended a study of this area to determine, to answer
8 the questions they say, have been raised?

9 A No sir.

10 Q Well, Dr. Rutter gave
11 evidence to suggest that an evaluation or at least
12 a preliminary evaluation of that east of the Franklin
13 route could be accomplished on the basis of evidence
14 already available. Now, if you accept that evidence
15 at the moment, would not recommend that this route be
16 studied before approving a route down in the Mackenzie
17 Valley?

18 A No, sir.

19 Q Why would you not
20 recommend it as an environmental consultant?

21 A Again, we see no great
22 difficulty in building down the Mackenzie Valley and
23 there are several other factors that have to be
24 considered. One of them would be the difficulty of
25 providing access to that proposed pipeline route and
26 you would end up with many miles of supply roads into
27 an area which now certainly has no facility whatsoever.
28 The, I would see no advantage to that route. It is
29 an area which is ^{perhaps} more properly described than any other
30 that we have looked at as a wilderness whereas the

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Koskimaki, McCart, Minning,
Williams
Cross-Exam by Anthony

Mackenzie Valley is already heavily disturbed and there would be little impact on the terrain on that particular route we have chosen.

Q Well, you may be right or Dr. Rutter may be right or Dr. Roed may be right but why would you not recommend that this study be conducted to determine these questions?

A Because I think the other factors rule it out.

Q What factors rule out an consideration of any other alternate?

A Such factors as supply, communication to it, the fact that it does not follow the Mackenzie which is the--has some potential as a producer of oil and gas. There is advantage to following the Mackenzie itself.

Q But you are now giving conclusions that you say you have not even studied. If you have not looked at the east of the Franklin route how can you come to the conclusions that it is not even worth studying?

A Because of these other factors.

THE COMMISSIONER: Well, these other factors, Dr. Hemstock, are clearly economic, that is, the proximity of the Mackenzie Valley route to potential oil and gas fields, the proximity to the river from the point of view of access by barge and by air too I suppose for that matter, these are the factors

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Williams

Cross-Exam by Anthony

tions that I take it led you and your colleagues not to consider the east of the Franklin's route or the edge of shield route.

A Yes, those are the major factors.

Perhaps another point that again to reiterate I do not see any great advantage from the standpoint of terrain because I do not see any great difficulty with the terrain with the route that has been selected.

MR. ANTHONY: Your advice then to Arctic Gas is not to examine even on the basis of existing material anything outside the prime route corridor.

A That would be my advice.

Q We have had one major route relocation which is the Fort Simpson route change that has been approved and presented by Arctic Gas. Could you tell me how consideration of that route change was initiated within Arctic Gas? And when it was initiated?

MR. MARSHALL: Mr. Commissioner, I hesitate to interrupt so early in the cross-examination of one of counsel but it seems to me that this was an area that was exhausted many times by a number of counsel with a number of witnesses on a number of occasions.

MR. ANTHONY: Well, I have had a number of evasive answers, a number of times from a number of people. I have now got a number of answers

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1 who is the fellow giving the advice to the engineers
2 and I am trying to find out what role he played in
3 that route change. We have had evidence from the
4 engineers as to what they consider as to why they did
5 what they did. We now have the first time their
6 environmental advisor who hopefully can give us that
7 information from his perspective.

8
9 MR. MARSHALL: I am sure it
10 was a slip of the tongue and he did not mean to say
11 that he had a number of evasive answers.

12 THE COMMISSIONER: I think we
13 will treat it as that.

14 MR. SCOTT: Whether or not, I
15 am sure it is, it seems to me that this line of ques-
16 tioning is absolutely critical. This project is
17 presented on the basis at least in part that this is
18 a pipeline, I suppose for the first time in North
19 America which has been selected by environmentalists.

20 MR. MARSHALL: I do not know
21 that there has been that presentation.

22 MR. SCOTT: Well that is the
23 impression that is being created. Now, that may not
24 be so or it may be so. I do not know. It certainly
25 is not what Mr. Dau suggested but it has been suggested
26 by some other witnesses that the environmentalists
27 have had input that has led to the selection of a route
28 and I think that should be probed because I understood
29 the evidence to be that in fact the engineers had selec-
30 ted the route and the environmentalists had reacted

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2 it and if they could not agree, well then the engineers
3 made the selection.

4 THE COMMISSIONER: Well, that
5 has been my understanding all along that that is--

6 MR. SCOTT: Well, the write-up
7 of the evidence of this panel and from what I can see
8 very quickly of the next panel suggests that rather
9 more than that that the environmentalists selected
10 this route in large part and if the environmentalists
11 are going to answer for it, I think that Mr. Anthony's
12 questions was quite in order. I think the public are
13 entitled to know whether this is a route that has been
14 selected by engineers and who had satisfied environment-
15 alists that they can build without any environmental
16 damage or whether conversely environmentalists have
17 played a role in selecting the route itself.

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THE COMMISSIONER: All right. Well,

I think that on the basis that Mr. Scott has put the
 matter Mr. Anthony is entitled to proceed. May I, please,
 you proceed, Mr. Anthony just put this to Mr. Herstock
 Dr. Herstock.

WILLIAM HERSTOCK: Mr. Herstock.

MR. HOLLINGWORTH: Maybe we
 have those involved in this case write PhD across
 foreheads to assist us.

THE COMMISSIONER: Well, they
 could wear their academic gowns.

MR. HOLLINGWORTH: That would
 even better.

THE COMMISSIONER: The impression
 I had from all of the evidence so far, Mr. Herstock is
 that the route for this pipeline was chosen on the basis
 of engineering and financial considerations and that it
 was only after the route was chosen that the environmental-
 ists such as yourself were asked to comment on it and
 suggest any changes that they wished to make and the
 standing was that there was really only one change of
 major importance and that was the change in the route
 made on the basis of environmental considerations in the
 vicinity of Travailant Lake and if I have if in fact
 this was chosen by environmentalists as Mr. Scott said
 the prepared evidence indicates I would like to know and
 I am sure so would everybody else here.

Have you any further questions?

given less importance to the role of environmentalists

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Cross - Exam by Anthony

1
2 than I should have?

3 WITNESS HEMSTOCK: No, I think that
4 you have it interpreted correctly.

5 MR. ANTHONY: Fine, if I could
6 proceed on that point. That certainly was my understanding
7 and I therefore did not proceed with the questions about
8 Travaillant Lake where I think we discussed the environ-
9 mental role in that decision and so on.

10 However, the route change at Fort
11 Simpson is a major re-alignment and I am wondering if
12 you would explain the role that the environmentalists
13 played in formulating and recommending that significant
14 route alignment change?

15 A I have just been trying to
16 recall the role that I played in that personally and I
17 can't recall the dates, but first of all, I had no great
18 difficulty with the original route as it was chosen from
19 Fort Simpson south and I believe that there were relatively
20 minor concerns, or perhaps no great concerns on behalf of
21 the specialists from an environmental standpoint. I think
22 that the question was first brought to my attention when
23 I read the report of the government and I have forgotten
24 whether it is the government assessment group, or whether
25 they posed a question to it with regard to the location at
26 Fort Simpson and from there on south and I can remember
27 discussing it with-- and I think Mr. Williams was there
28 from both the engineering and environmental standpoint.

29 I also discussed it with our environ-
30 mental consultants and I think the general consensus was

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1 that there was
2 not likely to be much difference from an environmental
3 standpoint either with the original route or the
4 proposed change. However each one of them emphasized that
5 in order to make that conclusion they would need to do
6 additional studies and we agreed that there was enough
7 benefit or advantage, there was enough question about
8 the route from there on that there was enough
9 done, so both engineering and environmental studies went
10 on at about the same time and on the basis of
11 that group has changed.

12 Again, from the terrain standpoint
13 I don't recall if there is very much advantage or
14 or the other and from the total of the people
15 the living environment there was really
16 choose as well. I believe that Dr. McCart, from
17 standpoint prefers the Fort Simpson change, the
18 route.

19 MR. SCOTT: Mr. Commissioner,
20 am reluctant to interrupt, but as we are dealing with
21 the Fort Simpson change, I understood Mr. McCart to
22 say that in cross-examination by Mr. Herston at
23 earlier stage that that route change had been
24 and selected and the environmentalists were in
25 of doing studies to assess it and that those would be
26 provided in the early autumn. I haven't ever
27 received those yet, as far as I know. Where are they
28 that the environmentalists made in which they comment on
29 the Fort Simpson route change? I have seen
30 only one into the record, that is the one that

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Koskimaki, McCart, Minning,
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2 one wonders what use has been made of them. In any event
3 we would like to see them.

4 I don't think I have it wrong. I
5 don't have a note of the page, but I think we have been
6 told that the environmentalists were in the course of
7 doing studies with respect to the Fort Simpson route change
8 and that those would be available to us. They were ob-
9 viously either done, or the reports based on them were done
10 after the route change was made, but in any event I would
11 like to have the studies when we can. It would be unfort-
12 unate I suppose if the studies reveal that the route change
13 shouldn't have been made.

14 A Those reports are
15 in preparation, although there are still mammal people in
16 the field, checking in winter conditions, but they will
17 be available.

18 MR. ANTHONY: Mr. Scott has touched
19 on one point and that is the additional studies. I would
20 like to follow up the other point. He stated that before
21 the decision was made to change the route there were en-
22 vironmental studies done. Now, your environmental state-
23 ment that goes with the route change runs to about three
24 pages and indicates very little, if any additional enviro-
25 nmental research. Now, is that the total of the environ-
26 mental information that was provided before the route
27 change was approved by Arctic Gas?

28 A No, There was
29 a good deal of additional discussion and again, I can't
30 recall, but the original routing of the route was done

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2 Mr. Williams can help us here, was I believe east of
3 Sirrson. so that there had been some studies done, prob-
4 ably in '71 or '72 of those general areas, not specifically
5 to that route, but those general areas and that infor-
6 mation was available to our consultants.

7 In addition, of course, they have
8 a general familiarity with the area and they were
9 looking at maps and aerial photographs and able to make
10 early judgments on it and these had to be confirmed by
11 field studies.

12 Q That route alternative was
13 beyond the window of the Arctic Gas program, is that correct?

14 A Yes, sir.

15 Q And so that I understand correctly, also outside of
16 the study area of the Environmental Protection Board
17
18
19 side the area studied by the Environmental Social Program.
20 Perhaps what we could do then, could you, through your
21 counsel, please provide us with the reports that were
22 available before the route change was approved? At that
23 a list of
24 what reports you, as the environmental consultants, provided
25 to Arctic Gas upon which they considered the change around
26 Fort Sirrpson?

26 A Yes, sir. We could do that.

27 Q And so that I understand correctly,
28 I believe you stated that the impetus for this change was
29 not from any environmental concern, or at least not an
30 environmental concern that you expressed to Arctic Gas.

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WITNESS HEMSTOCK: No, sir.

THE COMMISSIONER: It was based on
the avoidance of crossing the Liard, wasn't it?

A We saw some advantage in avoid-
ing crossing the Liard and Dr. McCart in particular said
that he would be happier with the new route.

MR. ANTHONY: Q Perhaps we can
then look at the cross-delta route change, or the possible
cross-delta route change. Now, I understand that Arctic
Gas is not, at this time, in a position to confirm or
deny that intends to use that change. Is that the
current position to date?

A That's the current position.

Q Could you tell me where the
impetus for that change came? Was it from the environ-
mental consultants that you are responsible for?

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A No sir.

THE COMMISSIONER: We were
told earlier that you would save something like 100
million by using that route, and that that was the
main reason.

A I believe that it's in
the order of 100 million dollars. I'm not sure, but
certainly I initiated looking at it from our standpoint,
and again we discussed it with Mr. Walker, who was at
that time the chief engineer with Arctic Gas, and also
with Mr --

Q Mr. Walker is now with
Foothills?

A Yes, and also with Mr.
Dau and Mr. Williams.

MR. MARSHALL: He's a consultant
to Foothills.

THE COMMISSIONER: He's with
Canuck Engineering, isn't he?

A . Yes.

Q He was on a panel here,
I remember.

A Yes.

MR. ANTHONY: Now I believe
there are studies, environmental studies that are
presently being conducted into the cross-delta route,
and these are in the process of being completed now,
are they?

A Yes, they are.

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Q And any decision on the
cross-delta alternative will have to await considera-
tion of those environmental reports, I gather.

A That's right.

Q And are you in a position
at present to give any environmental assessment, compar-
ing the two routes that are being considered at present?

A No, I think that we
should cover that in the session for the cross-delta
routing.

Q I see, so you'll be
prepared to go into this in detail at that time?

A Yes.

Q Thank you. When Mr. Purcell
appeared before us, he advised that the mode of the
pipeline, a chilled buried pipeline was given to his
advisors and consultants that worked under him. Now
was the mode of construction, i.e. buried chilled
pipeline, given to the environmental consultants?

A No, as I recall it was
not.

MR. MARSHALL: I don't recall
Mr. Purcell's evidence to the effect that it was given.

THE COMMISSIONER: Well, in
any event, the question is whether ^{it was} a given so far as
Mr. Hemstock was concerned.

MR. ANTHONY: And therefore the
environmental advisors were in a position to consider
alternate modes throughout the full length of the

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Cross-Exam by Anthony

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2 pipeline route?

3 A Yes.

4 Q And did you conduct
5 studies and consider these sorts of changes?

6 A I don't think we conducted
7 studies, but certainly the environmental consultants
8 expressed concerns over other modes of construction,
9 and warned of difficulties that they could see from
10 an environmental standpoint with other methods of
11 construction.

12 Q I would assume, or can we
13 assume that you also warned them of dangers of the
14 proposed method of construction?

15 A Yes, but we saw much
16 less difficulty.

17 Q Did you isolate or
18 concentrate on any particular areas of the route
19 where for environmental reasons ^{solely} you wished them to
20 consider, for example, a pipeline elevated above the
21 ground?

22 A No sir.

23 Q Did any environmental
24 consultants that were reporting to you recommend that
25 at particular locations the pipeline go above-ground?

26 A No.

27 Q So all the environmen tal-
28 ists that you're responsible for in reporting to you
29 were satisfied that from an environmental standpoint
30 there should be a buried chilled pipeline throughout

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Cross-Exam by Anthony

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2 the entire system?

3 A Yes, I think that's
4 correct.

5 Q We obviously will be
6 getting into this in greater detail, but since we
7 have Dr. McCart with us right now, is there not a
8 single location which in your opinion would warrant
9 consideration of a river crossing above-ground or
10 some such other variation than a buried chilled mode?

11 WITNESS MCCART: Well, I think
12 at one point I vaguely recall discussing Thunder River
13 crossing, which looked to us to be relatively steep,
14 mentioning -- asking whether this was a possible
15 alternative in that particular area and the engineers
16 satisfied us at that time that they felt they could
17 in fact go down those slopes and up the other side
18 with a stable crossing.

19 There is one other area where
20 I casually suggested an elevated crossing, and that is
21 possibly in the headwaters of, upstream of one of the
22 springs that was shown yesterday. I think there is
23 this problem of freezing off aquifers upstream of
24 a spring orifices as an alternative to burying a
25 pipe and shutting off an aquifer, or bringing the water
26 to the surface prematurely, one possible solution is to
27 elevate the pipe. So that we have mentioned that.

28 However, this is an area where
29 we are going to have to do an on-site inspection and
30 determine whether it may be possible simply to insulate

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1 the pipe as the engineers are now suggesting. They
2 will accomplish the same thing.

3 THE COMMISSIONER: You mean
4 elevate the pipe just for a short distance?

5 A Just for a short distance,
6 if it looks as if there is an aquifer very close to
7 the surface. Now one of the ones we were concerned about
8 was the one with the nitrogen bubbles coming out of it.
9 We have looked at the water chemistry of this and the
10 fact that there are nitrogen bubbles, all of these
11 things tend to suggest it is a very deep aquifer rather
12 than a shallow one, so it may not be a problem at all.
13 However, it is one situation where we want to go in
14 and do an on-site inspection. Other than that I see
15 no advantage to having the pipeline elevated.

16 MR. ANTHONY:

17 Q And you say that because
18 you're satisfied or the engineers have satisfied you
19 they can deal with the sorts of problems that might
20 concern you as an environmental consultant?

21 A Yes, we have suggested
22 where there might be problems, and they have satisfied
23 us that they appear to know what they're talking about.
24 Not being an engineer myself, I can't make a technical
25 assessment. So wherever necessary, we pointed out
26 potential problems.

27 THE COMMISSIONER: They have
28 satisfied you that they appear to know what they're
29 talking about. I think you meant to put it emphati-
30 cally but you didn't.

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2 A O.K., they have already
3 considered these problems. Someone else will have
4 to assess their technical competence. A left-handed
5 compliment of a sort.

6 MR. ANTHONY: Perhaps if
7 we could look at another aspect of the physical impact,
8 and I turn to the question of scarce resources, and
9 in particular consideration of borrow requirements.

10 Q Now in question 9 in the
11 questions by the Pipeline Application Assessment Group,
12 you requested that Arctic Gas indicate the approaches
13 they intend to take concerning the use of scarce resources.
14 In response to that, in the third paragraph in response
15 to question 9, I'll perhaps just read the sentence
16 for those who don't have the responses before them,
17 they state:

18 "Another alternative which will be examined
19 in appropriate circumstances will be the use of
20 aggregates from more distant borrow pits and
21 quarries where necessary to conserve local
22 resources, and when transportation is feasible."
23 I'm wondering if you could expand on that response
24 and give an indication of the type of considerations
25 that go into determining whether or not appropriate
26 circumstances exist for travelling further for borrow
27 sites?

28 WITNESS MINNING: I think I
29 can comment on this subject. For example, in the area
30 around Fort Norman, there is a scarcity of good quality

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1 gravel on the east side of the Mackenzie River. There
2 is one source across from Fort Norman on the west side
3 of the river where good gravel is present. Possibly
4 this gravel could be exploited, brought across the
5 river either on barges, or in the winter at which time
6 there would probably be less, this statement would apply
7 then.

8 Q I'm wondering whether or
9 not there have been any guidelines in environmental
10 terms as to when you should go beyond to get borrow
11 sources? I can appreciate it when you don't have enough
12 gravel there you may have to go further beyond. But
13 are there any other circumstances where you may want
14 to travel further to get gravel rather than use all
15 the gravel that's in a particular location.

16 A Yes, I think there are
17 cases like that. For example, if there is a community
18 area where gravel is being reserved for the community,
19 we would certainly have to go to another source that's
20 further away.

21 Q Would you recommend
22 therefore some form of consultation with the communities?

23 A Definitely.

24 Q This is a recommendation
25 which you have --

26 A We have been in contact
27 with DIAND over the subject of borrows for some time,
28 in fact DIAND has asked us for the quantities that
29 we require on segments that they have proposed along
30

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1 our route.

2 THE COMMISSIONER: They have
3 asked you for the quantities of borrow that you require?

4 A That's correct, they've
5 divided the pipeline route into segments. They want
6 to know in each segment of the pipeline ^{route} how much we
7 require, how much the highway requires, how much is
8 required for a railroad et cetera.

9 Q What about an oil
10 pipeline?

11 A And an oil pipeline.
12 Now they have figures in their report which was published
13 in March, 1975, that claims certain quantities will be
14 required for each of these activities. We doubt that
15 the requirements for looping a gas pipeline, as they
16 state; but other quantities, we don't know how they
17 were derived.

18 Q Mackenzie Valley Research,
19 that oil pipeline company that went out of existence
20 and has now been ressurected, apparently, they cal-
21 culated 40 million cubic yards of borrow for the oil
22 pipeline. Is that a figure that you're competent to
23 say anything about, or do you dispute it, or --

24 A I don't think we dispute
25 that figure in particular.
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Q What figure did DIAND
give for the quantity of borrow required for looping
the gas pipeline?

WITNESS CLARK:

A They doubled the figure.
That is the computation that we would dispute since the--

Q You do not need as much
second for the looping?

A Oh no. Most
of our requirements are for stations and airstrips and
so on which you would not duplicate. Our estimate is
about a 20% increase.

Q You mean the 30, we had
24 plus 7 or no, we had 24 plus 7, let us say 30. You
are saying 20% of that for the looping.

A Yes.

Q And they said--

A They arbitrarily doubled it
and I do not think they looked at the fact that we
would not dual airstrips.

Q Carry on, Mr. Anthony.

MR. ANTHONY: You mentioned
this concept or a recommendation that you had made that
there be consultation with the community before utili-
zation of a borrow site. Is that correct?

WITNESS MINNING: That is
correct.

Q And have you initiated
such a consultation program as part of your research on
borrow site locations?

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A We have not done that as
yet.

Q Have you provided any
in
guidelines, if I can use the term, 'environmental terms
as to the use of borrow sites? For example, only
taking borrow up to 90% of a source or only using a
certain area or only digging in certain areas to a
certain depth or anything of that nature?

A These things are con-
sidered for each site and before a site is developed,
a development plan will be submitted for the site to
include this sort of recommendation.

Q Now, are you in the
process now of formulating these type of guidelines?

A Yes, we are.

Q And is that part of the
summer research that you conducted this summer?

A No, the summer research
was oriented toward proving up sites that we suspected
from office studies that fell outside of sites that
other people had already documented.

Q Are there other studies
then currently being conducted to set up this sort of
environmental protection guidelines?

A Yes, there are.

Q And who is conducting
these and when will they be available?

A Northern Engineering
is presently involved in this sort of development

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plan idea and has to be done in connection with several different groups including the construction engineers, environmentalists, geologists.

Q I wonder if Mr. Williams or someone knows where these studies are at present and when we might expect to have the results of these studies.

WITNESS CLARK: The reports on the summer program and I hope I am not confusing your question that is early next year the types of developments that we would propose to use are illustrated in the report that we produced last March. That was developed with the environmental input and we also had a preliminary environmental assessment of all the areas that we had identified as being potential sources of borrow. In each case the consultant indicated what his concern was and where we would have to have site specific assessment. So, again I hope I am not confusing but the site's specific assessment would come at the time that we were making an application to use that source of borrow. Then it would followed by a development plan that would, I presume, be submitted for the obtaining a permit to use it.

Q I can appreciate that as you apply for a permit to use a particular site you will have to as part of your development plan outline environmental protection measures but I am wondering whether anybody is conducting any studies now to determine the sorts of terms and conditions that might be applied to a permit, or the types of terms and

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conditions you could live with in a permit to use a
borrow site.

A Yes. I believe we
are. That is part of this total assessment of granula
borrow that we are doing now or borrow rather, not
granular borrow but all borrow.

O And that is part of the
study that was done over the summer or this is another
study?

WITNESS MINNING: This is not
part of the study that was done this summer. The
summer study was a granular materials inventory study
which is not the same thing.

O You have got me then.
Where is the information then on this other study that
you have now identified.

A This is not published
information. We are just starting to work on this for
each type of deposit.

O And is that expected to
become in a report that will be available to this
inquiry?

WITNESS CLARK: Your question
is when is that report going to be ready?

WITNESS MINNING: At present,
We have not had too much success in communicating with
DIAND on the sort of things that they want to us
include.

MR. ANTHONY: So that is the

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continuing report that will be available as soon as.

A That is correct. We
are also in the process of obtaining information on
their highway requirements are going to be and communi-
ties. It is a very long process.

Q And you are presently
getting this information from DIAND, are you?

A Yes, I hope so.

Q Now, you refer in your
evidence and in other material to have preferred and
alternate borrow sources. Now, could you tell me what
environmental considerations went into determining
which is a preferred source and which is an alternate
source?

A I can think of several
cases of an alternate source in the heart of the valley
where there are no active flood plain borrows
was originally a flood plain. I think that exists in
one place. And it was obviously not the first choice
because of environmental reasons.

Q Did you provide any
environmental guidelines to express a preference between
use of say upland sources as compared to active flood
plain sources?

A Could you state that
again please?

Q Did you prepare any
environmental guidelines that would express a preference
between using active flood plain as compared to upland

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sources?

MR. MARSHALL: Excuse me, Mr. Anthony. Perhaps it might help if you want to get at some sort of an assessment as to the relative of one or the other, you might ask Dr. McCart because as a consultant dealing with that subject area, he would be providing information to Miss Minning.

MR. ANTHONY: Sorry. I meant to direct it to the panel as a whole. If Dr. McCart wishes to respond then I am quite prepared to hear him, obviously.

WITNESS CLARK: I think that if I understand your question the response might be that the environmentalists that looked at it were free to-- we did not put any restrictions on how they--in other words, we did not give any guidelines other than to indicate that from our engineering point of view this is what we preferred and this could be an alternative.

THE COMMISSIONER: I think he wants to know whether the environmentalists laid down any guidelines. Is that what you are getting at?

MR. ANTHONY: Yes, thank you.

WITNESS MCCART: Well, my understanding of the process was that preferred and alternate sources were--the reference to them as being preferred or alternate was strictly on an engineering basis. Now, we have commented on each of these sites at one point some time now for the past several years and indicating where we thought that an alternate was

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1 simply out of the question and things of this sort.

2 We expect during the final designing phase to go in
3 and look at each of these gravel sources from my point
4 of view of course we are particularly interested in any
5 source which has to be in an active flood plain and we
6 would at that time make comments, cite specific comments
7 and also cite, define site specific mitigative measures.
8

9 Now, we have listed
10 general criteria for any pit or borrow source which
11 is located in an active flood plain. And these appear
12 in several places in the application in responses to
13 questions of one kind or another.
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Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 Q I was thinking in more
3 general terms. Now, would you for example, as an
4 environmental consultant to Arctic Gas, suggest that
5 they use as primary sources upland rather than active
6 flood plain?

7 A From a Fisheries point
8 of view, yes, I certainly would.

9 Q And have there been
10 guidelines issued by other consultants dealing with
11 other aspects of physical terrain?

12 A I'm sure there have.

13 WITNESS HEMSTOCK: Perhaps I
14 could comment on that, that again it's a matter that
15 you have to have all of the factors before you before
16 you make the decision, and while Dr. McCart might
17 prefer an upland site, certainly from the standpoint
18 of perhaps wildlife, birds, the preference would be
19 for a site on the flood plain. From an aesthetic
20 standpoint, the borrow pit, which is on a flood plain
21 and which will be virtually unnoticed in a year or two,
22 is much preferable to one on an uplands site. Just
23 as an example, very often a preferred upland borrow
24 site is also a good denning area, and one of the
25 requirements that we have is that these denning areas
26 not be disturbed. Perhaps you'd be able to get
27 sufficient borrow out of an area without disturbing
28 the dens in an upland site, but the den sites themselves
29 not be disturbed.

30 Those kind of general guidelines

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Cross-Exam by Anthony

1 have been provided, but it's a matter of continuing
2 that on an individual site basis.

3 Q You've had these
4 general guidelines. Were you involved in the actual
5 site selection process for borrow sites?
6

7 A I think the indication
8 was that there was an environmentalist along with the
9 crew that was looking at those sites.

10 WITNESS MINNING: The initial
11 site selection was based on the material that was
12 present, or it wouldn't be good borrow necessarily.

13 Q I'm still not sure of
14 the answer then. Were there -- were the environmental
15 advisors involved in the selection of the sites?
16 Once you identified various sources of borrow in a
17 particular area, were they involved in the selection
18 of the site and the designation as either a prime or
19 alternate site?

20 A Yes, they were. In fact
21 I can think of a site in Alaska in which case we
22 were moved from one site to another for environmental
23 reasons only.

24 Q Are there any sites
25 presently designated as primary or alternate sites
26 for borrow within the Canadian portion that environ-
27 mentalists or environm ental advisors have objected
28 to, or are they satisfied with the sites as presently
29 designated?
30

A They've expressed

Clark, Dabbs, Harlan, Hemstock
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reservations on certain of the sites.

Q And are these --

THE COMMISSIONER: Well, maybe
we could adjourn for lunch and come back at two, would
that be all right?

(PROCEEDINGS ADJOURNED TO 2 P.M.)

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(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR. MARSHALL: Mr. Commissioner, this morning a question was raised as to the route changes that were under consideration by the engineers at N.E.S. Mr. Williams can comment on that and provide some information.

WITNESS WILLIAMS: Mr. Commissioner, when the route selection panel was here, I think we said -- I haven't taken the time to look it up in the record, but I'm sure that we said that the pipeline could be constructed along the route as filed. I'm sure we also said that we would like to retain a bit of flexibility so that minor changes could be made as new information came forward, these would be improvements in the route, and certainly they wouldn't be made without consultation with the environmental groups.

Now Mr. Scott this morning suggested we might talk about the serious changes, and I wasn't sure whether he meant changes that we were seriously considering, or changes that would be made for serious reasons. I take it to be the latter, and -- I beg your pardon, sir?

MR. SCOTT: I presume the first includes the second. You wouldn't have a substantial change if it wasn't made for serious reasons.

MR. MARSHALL: That's the second including the first.

THE COMMISSIONER: Well, go you

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Cross-Exam by Anthony

1 mean the change that would have some major impact
2 even if it were over a short -- well, you carry on,
3 we shouldn't be interrupting you.

4 A Well, I've taken it to
5 be a change made because of something serious we have
6 found along the route, and there are really only two
7 that we would put into that category:

8 (1) is at the Great Bear River, where we're looking at
9 a new location for the crossing a little less than a
10 mile upstream of the location filed

11 (2) the second area of concern, I'm sorry, we're
12 looking at that because of possible instability of
13 the Great Bear River bank, and the other location is
14 at Rapid Creek, which is on the Yukon coastal plain
15 near the Blow River. The Rapid Creek empties into the
16 Blow River and it has some very steep banks that show
17 some indications of instability, and we're looking to
18 try to improve that crossing of Rapid Creek.

19 The other possible changes
20 that we've looked at are very minor and not serious.
21 There wouldn't be a great improvement if these other
22 changes were made.

23 Now it was mentioned that we
24 did have a reconnaissance this summer of an inter-
25 disciplinary group that went over and particularly
26 looked at river crossings, and these changes mainly
27 stem from that reconnaissance. The reason we are
28 dragging our feet on it is that -- because the people
29 that should be looking at these things more seriously
30 are tied up in hearing work, like Dr. Clark and Dr.

Clark, Dabbs, Harlan, Hemstock
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Williams
Cross-Exam by Anthony

1
2 Harlan and Dr. Hollingshead, Mr. Dau and myself and so
3 forth, and I don't know when we're going to get around
4 to doing something serious about it.

5 THE COMMISSIONER: How does the
6 week of November 24th sound?

7 A In any event, we have,
8 we at Northern Engineering have not recommended any
9 route changes to Canadian Arctic Gas at this time.
10 The changes that are are considering are strictly in
11 house in Northern Engineering, they have not been sent
12 to the environmental groups, they're strictly red lines
13 on mosaic sheets.

14 MR. SCOTT: For my part,
15 I'm satisfied with what Mr. Williams says and it seems
16 to me that that complies with what I was looking for
17 this morning, with one reservation, a change that is
18 made no matter how minor, for some engineering or
19 technical purpose, which -- in which we may not be
20 particularly interested, may conceivably have environ-
21 mental consequences or social consequences which may
22 be known to the applicant but which may not be known
23 to the applicant. Therefore, as these things come
24 forward at an early stage we would be grateful to know
25 if it be simply a question of showing us red lines on
26 an alignment sheet, what is proposed so that we can
27 begin to assess them from our particular points of
28 view. It may be, for example, if we're shown a red
29 line on an alignment sheet of something that is
30 being seriously considered by N.E.S., we may be

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Cross-Exam by Anthony

1 able to say, "Well, that has the following implications
2 and we may even be able to persuade them to reconsider
3 it, or to withdraw it, or to do something else."
4

5 The geographic dimension of
6 a change does not necessarily have anything to do with
7 its environmental or social implications; but if Mr.
8 Marshall can see to it that as these things reach a
9 stage of development we could be shown at the very
10 least the red lines on the alignment sheets, I think
11 that would be helpful to all of us.

12 MR. HOLLINGWORTH: Mr. Commis-
13 sioner, while we're on the same topic, Mr. Scott left
14 the impression this morning that Foothills forgot
15 to honor an undertaking with respect to route locations,
16 and I might refer him to Exhibit 231 and 233, which are
17 respectively the recommendations of Klohn Leonoff
18 and Lombard North as to adjustments in our line.

19 MR. SCOTT: I'm ticked off.

20 THE COMMISSIONER: Don't let
21 it happen again.

22 MR. SCOTT: I just got to
23 Exhibit 220 in my ongoing review.

24 MR. HOLLINGWORTH: Speed it
25 up.

26 MR. SCOTT: The week of
27 November 28th.

28 THE COMMISSIONER: Mr. Anthony?

29 M R. ANTHONY: Mr. Commissioner,
30 just before we broke I'd asked Miss Minning a question

Clark, Dabbs, Harlan, Hemstock
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Cross-Exam by Anthony

1 about compressor station locations, and whether any
2 concerns
3 /had been expressed for environmental reasons, and I
4 believe she stated that a number of concerns over a
5 number of stations had been voiced, and I'm --

6 WITNESS MINNING: Borrow sites.

7 Q Sorry, borrow site
8 locations, and I was wondering whether there were any
9 particular borrow sites that were presently being
10 examined because of these concerns that have been
11 expressed?

12 A I might say that in our
13 reconnaissance this summer and in our program of
14 drilling and test-pitting, we did have an environmental-
15 ist go to each one of the sites and his comments are
16 going to be included when we write up each of these
17 sites. I think maybe I should clarify the whole
18 process of selecting borrow and applying for borrow
19 pit development, because I think there is some confus-
20 ion here. I don't know, borrow sites are chosen first
21 of all because they have good material. In our
22 case we've tried to pick sites that had good material.
23 We didn't necessarily do that 100%, as I understand
24 there's one site that's been depleted that was chosen
25 in the beginning. These sites are chosen and described
26 mostly from air photos, geological maps, granular
27 materials and inventory work that was done by others.
28 This summer we tried to visit the sites we had chosen
29 to see if they really did have good borrow, and in
30 some cases we visited sites that were not described by

Clark, Dabbs, Harlan, Hemstock
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Cross-Exam by Anthony

1 anyone else, and found that many of these sites were
2 good. When we go to develop a site, we of course expect
3 to comply with all the rules and regulations that DIAND
4 will set down; included in this will undoubtedly be
5 a development plan similar to those that we have shown
6 in our borrow report. We expect one like that for every
7 deposit that we intend to develop, and we expect that
8 certain pits that we choose will probably be turned down
9 for some reason that we are not aware of at this time.
10 For example, a community may need more than we are
11 aware of, and we will be told we have to go somewhere
12 else , and we are prepared to go somewhere else.

13
14 Also we're prepared to have
15 an environmentalist go each time that we decide on a
16 site, and draw up our plan, there will be an environ-
17 mentalist involved in the drawing up of the plan for
18 the site.

19 Q So that the sites that
20 are shown on the alignment sheets indicating preferred
21 and alternate have been selected in the process you've
22 outlined, and now you're in the process of doing an
23 environmental and community evaluation to decide whether
24 you're going to change or amend or use different sites
25 than those that are indicated.

26 A That's correct.

27 Q I'd like to look more
28 specifically now at the use of gravel from the active
29 flood plain, and it might assist you and I if we could
30 refer to the flood plain development plan that Mr.

Clark, Dabbs, Harlan, Hemstock
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Williams
Cross-Exam by Anthony

1 Minning, you used yesterday as a slide, and I believe
2 it was distributed to us all in a mimeographed form.
3 Now you've indicated in your evidence that you will
4 be taking gravel from the active flow channel when you're
5 taking it from the active flood plain, and I look at
6 the flood plain development plan and the cross-section
7 which is in the middle of that page, it appears to me
8 that in fact you will be taking gravel right up to the
9 edge of the active channel. Is that in fact the
10 plan in this particular location, and in the other
11 locations? Perhaps other counsel can see where I'm
12 looking at, the -- in the middle of the page it says:

13 "Existing cross-section,"

14 and above it:

15 "Final cross-section."

16 It's the slide on the flood plain development plan, and
17 I'm looking now at the cross-section which appears to
18 me to indicate that activities will continue right up
19 to the edge of the active flood plain. Sorry, edge of
20 the active channel.

21
22 A It might and it might
23 not. It shows on this plan that way that you speak of.

24 Q In what circumstance would
25 it include borrow activities right up to the active
26 channel?

27 A If there was no environ-
28 mental objection from a fish point of view, or if it
29 wouldn't affect the river regime.
30

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

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2 Q In this particular case,
3 I believe you're referring to Rapid Creek at proposed
4 borrow development No. 138. Now could you tell me
5 whether in that particular location you intend to
6 mine gravel right up to the active channel?

7 WITNESS McCART: Just to make
8 a point, Rapid Creek is one of these small streams that
9 we expect to be frozen during the course of the winter.
10 It is occupied by grayling and we would certainly
11 recommend a buffer zone be left, or a substantial dyke
12 to ensure that there is space between the actual working
13 area and the river channel in this particular instance.

14 Q There's no indication
15 in this proposed development plan that such is intended.
16 Now, did the people who prepared this development
17 plan not consult with the fisheries?

18 A Yes, they did. We made
19 comments on this particular plan at some time in the
20 past.

21 Q Do I understand that this
22 is still the proposal for borrow pit development in
23 that particular area?

24 WITNESS WILLIAMS: Well,
25 irrespective of what the drawing shows, Mr. Anthony,
26 on page 46 of the direct testimony it says:

27 "A buffer zone will be left between the
28 borrow operation and the stream channel,"
29 and I think that would take precedent.

30 Q So do I understand the

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 position then, that in every case there will be a
3 buffer zone or berm of some sort between the active
4 channel and the borrow pit operations?

5 A Yes sir.

6 WITNESS McCART: It says that
7 on page 46, and also:

8 "A berm will be built to separate the borrow
9 pit from any channel of flowing water thus
10 effectively..."

11 Q O.K., so in fact, Miss
12 Minning, I believe the advice now is that in every
13 case there will be such a development. There will be
14 a buffer zone or a berm in each or every case?

15 WITNESS MINNING: Yes.

16 MR. MARSHALL: You're supposed
17 to say, "And it also says it at page 46," and read that
18 same statement.

19 A I might add that these
20 drawings were done in an early -- earlier on in the
21 project before the full significance of the buffer zone
22 was realized, before Alyeska was visited. These draw-
23 ings were taken from a report that we did at that time.

24 MR. ANTHONY: Well, I must
25 say that I anticipated moving on to the next point,
26 because it had indicated it in fact was going to be
27 used. Your initial response caused me to pause. Fine,
28 so I understand from this drawing, and please correct
29 me if the drawing is not an accurate representation of
30 what you propose to do, but from that drawing it

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1 appears that you proposed to remove gravel to the level
2 of the stream bed, in other words beyond the water level
3 down to the bottom of the level of the stream. Is that
4 what you propose to do?

5 A No.

6 Q To what depth do you
7 propose therefore to move gravel from the active
8 flood plain?

9 A We're going to go generally
10 down to water level.

11 Q Is that in every case of
12 borrow pit activity on the active flood plain, go down
13 to the existing water level and no further?

14 WITNESS CLARK: I think it
15 would be awfully difficult to say, "in every case,"
16 that's the general intent, that we wouldn't mine below
17 the water level.

18 Q In what circumstances
19 would you propose to allow mining below the water
20 level?

21 A If there was an active
22 flood plain that was very, very wide and was well
23 removed from the nearest active channel, such that it
24 would be possible to get down below that channel, it
25 might be several hundreds of yards away, it is possible
26 that one would go below that level there; but again it
27 would have to be only if there was no environmental
28 concern or reason not to, and also that we wouldn't
29 affect the river regime in such a way that it could
30 affect the pipeline.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

Q Dr. McCart, can you give
me any suggestions about the circumstances where you
would not allow the mining of gravel to go below the
water level in the active flood plain?

WITNESS McCART: In situations
where it might lead to ponding, is one of our major
concerns. There is some evidence that grayling differ
from other stream-dwelling fish, and this is a grayling
stream. I should point out, and they don't have the
same tendency -- they don't have the same escape
response that you have in some other fish, and they
have a somewhat greater tendency to become entrapped
as water levels decline, so in a situation like this
we would not want this kind of thing if it were to
lead to ponding. Hence our recommendation that once
these areas have been utilized, the berm would keep
water out, and fish out, during the actual process
of windrowing the gravel, and once the use of the
area is over, it's going to be levelled to prevent
this kind of ponding.

Q During the time of
actual operations, you're confident that the berm
would be sufficient to keep water from seeping into
the borrow operations?

A Well, my concern is
that in one of our reports we indicated that we have
ensured that the bottom end of the berm is also closed.
We don't feel that it's going to be possible to keep
all water from entering these areas,

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1 simply because water can move through this granular
2 material, and we certainly don't want the introduction
3 of impervious materials into the berm to prevent this
4 kind of thing; but we want to be assured that the
5 bottom end of the berm is also closed so that materials
6 moving through the working area again have to move
7 through a berm before entering the stream, and under
8 these conditions most of the fine material will be
9 sorted out as the water then passes through the
10 downstream end.
11

12 Q Is it the intention to
13 utilize the same material that you are mining with the
14 gravel in the active flood plain to construct the
15 berm?

16 THE WITNESS: Yes.

17 Q So that the berm would
18 be constructed in each case by the gravel that's
19 located naturally in that flood plain.

20 A That is correct.

21 Q I believe that you now
22 have on-going studies which will examine the effective-
23 ness of this berm technique, or are you presently
24 satisfied that this technique will be sufficient?

25 A We're satisfied that
26 it will be sufficient.

27 Q What time of the year do
28 you propose to commence borrow operations in the active
29 flood plain?

30 A It's generally late summer

Clark, Dabbs, Harlan, Hemstock
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Williams

Cross-Exam by Anthony

1
2 that the berm would be built and the windrows would
3 be developed so the gravel would have time to drain
4 before it was hauled the following winter.

5 Q And how do you propose
6 to get your equipment to and onto the active flood
7 plain on the North Slope? Or sorry, I should identify
8 that particularly, more generally, could you describe
9 how you will be getting the equipment required for
10 borrowin g to the active flood plain?

11 WITNESS WILLIAMS: It will be
12 brought to the site the previous winter over snow
13 roads.

14 Q And it would then be
15 left in the general vicinity over the winter period?

16 A Yes sir.

17 Q And the equipment would
18 be, in each case of the borrow site, would it be used
19 as part of the construction equipment, and then left
20 when the construction crew moves away, or how do you
21 propose to utilize the equipment?

22 A I didn't quite follow
23 that, Mr. Anthony.

24 Q Perhaps we can deal with
25 this particular example here. Now do you propose then
26 to move equipment there over snow roads in advance of
27 the construction, I gather?

28 A Yes sir.

29 Q So there will be snow
30 roads built and the equipment will be left there for

Clark, Dabbs, Harlan, Hemstock
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Cross-Exam by Anthony

use in the late summer of the following year?

A Yes sir.

Clark, Dabbs. Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams.

Cross - Exam by Anthony

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MR. ANTHONY: Q This gravel
will be piled in windrows and will be allowed to dry or
to drain until the winter season, when it will be used?

A Yes, sir.

Q Is it the intention to do
any borrow operations on active flood plains during the
winter months?

A The hauling of the gravel that
was stockpiled during the previous summer would be done
in the winter months, yes.

Q But you do not propose to
select, or actually do the borrow operations during the
winter months?

A I think that would be pretty
difficult. It would be frozen up pretty tight.

Q So, in each case the borrow
operation would be completed in the summer period and
before the winter construction season starts?

A The gravel we pushed up into
the windrows in the late summer and fall will be hauled
to its end use location during the winter and the site
then, the borrow site, will be levelled off and the dykes
breached before the site is left in the wintertime.

Q And the removal of the dykes
would then take place in the wintertime?

A Yes, before spring breakup.

Q On the bottom of page 5, the
direct evidence, the last line on that page states that
borrow pits which will be used during all seasons, will

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Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning,
Williams.
Cross - Exam by Anthony

1
2 have permanent access roads. Now, I am wondering per
3 if someone more familiar with the preparation of this
4 evidence can help me, because I have, in the review
5 the alignment sheets, been unable to detect where
6 permanent access roads to borrow sites are to be loca

7 A Would you like to go to the
8 strip maps and pick out a site, Mr. Anthony and mark
9 we could discuss it?

10 Q Well I have examined those
11 in particular around, for example Fort Good Hope,
12 was referred to in one of the slides and I was unable
13 the alignment sheet maps, which had been pulled out
14 indicate the access roads. Now, are there roads in
15 ition to those shown on the alignment sheets
16 be used?

17 A Snow roads along the right
18 of way. yes.

19 Q So, that there are i
20 areas where you plan to use summer roads for purposes
21 of moving gravel for maintenance repair and so on?

22 A In some locations, yes.

23 Q Those are the ones that
24 indicated as put on the strip maps?

25 A The all-weather roads are
26 a heavier dot than the temporary roads which are a light
27 smaller dot.

28 Q Could you tell me, Mr.
29 I imagine, whether it is expected that gravel washing
30 be used?

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams.
Cross - Exam by Anthony

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3 A Yes. That will probably be
4 required for some of the concrete weight manufacturing
5 not necessarily all. Concrete weights don't have to
6 a high-quality concrete.

7 Q Would you expect that this
8 process would be required on gravel that is on the active
9 flood plain as well as the uplands' sources?

10 A Now, we are just the only
11 place we are taking from the active flood plain is on
12 the coastal section of the route. I would think that
13 the gravel there would be stockpiled probably at the
14 station site and the weight casting would take place
15 at the compressor station site, after the pad had been
16 built.

17 Q Could you tell me the process
18 followed in gravel washing and what protection measures
19 you propose to incorporate to ensure that the sediments
20 in the washing does not adversely effect the environment
21 in an area?

22 A It would be done in an area
23 where a distilling pond could be constructed to keep the
24 water, the water with fines in it, running directly into
25 streams.

26 Q And these ponds would be used
27 in each case where there is a gravel washing operation?

28 A Yes sir.

29 Now, you mentioned the use of flood
30 plain as a borrow site location. Have you considered
use of the islands and bars in the Mackenzie River?

Clark, Dabbs, Harlan, Hem
Koskimaki, McCart, ~~Williams~~
Williams.
Cross-Exam by Anthony

A No, sir.

WITNESS MINNING. These genera
do not have very good gravel.

MR. ANTHONY. Q And so there
no intention then to use, or to alter these bars as
site locations?

A No borrow sites show on the
bars.

Q And would you recommend that
that these bars not be used as sources of borrow?

A Yes, I think so.

WITNESS WILLIAMS. We had some
recommendations from our ornithologist not to use them
for borrow sites.

Q And you would be taking
advice?

A Yes, sir.

Q Would you agree also
basis of his advice that there should be no alteration
the existing spits and bars and barrier beaches in the
offshore islands, off the Yukon coast?

A That has also been their
commendation.

Q And that is also your intention
at this time?

A Yes sir.

Q Now I understand that one
the alternate borrow sources at ~~the~~
such an area and could somebody bring me current

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Clark, Dabbs, Harlan, Hemstoc
Koskimaki McCart, Minning,
Williams.
Cross - Exam by Anthony

1
2 whether that idea has been abandoned, or whether it is
3 still a possible source of borrow? This is, I am advised
4 PM 47.

5 WITNESS MINNING: Are you speaking
6 of the alternate to the preferred site now?

7 MR. ANTHONY: Q I believe
8 is an alternate site.

9 A I think you could say this
10 one we were reconsidering. yes.

11 Q No decision has been made to
12 abandon the use of that site at this time?

13 A Our choice in that area is +
14 preferred site.

15 Q Yes, I appreciate that.
16 trying to determine whether Mr. Williams in his response
17 suggested that these would not be used and I am indicating
18 this one is indicated as an alternate and I am just
19 ering whether it still is an alternate site, or whether
20 you have made any determination about excluding these
21 sorts of sites as possible borrow sources?

22 WITNESS WILLIAMS: The location
23 the sites? Are you going into something in more detail
24 than what is shown on the strip maps, Mr. Anthony?
25 there- Do you have some other report? I have quite
26 forgotten.

27 My recollection of Shingle Point
28 that there is a gravel pit developed there for the Dow
29 Line site and I don't think it is a spit, but were you
30 there this summer, Miss Minning?

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Clark, Dabbs, Farlan, Hemstock
Koskimaki, McCart, Minning,
Williams.
Cross - Exam by Anthony

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3 WITNESS MINNING: I wasn't at that
4 site. The program did go there.

5 WITNESS WILLIAMS: I really don'
6 think it is shown out on the Beaufort Sea, on the, or it
7 is shown on the Beaufort Sea, but that's just illustrated.
8 My recollection of Shingle Point is that the gravel pit
9 is not a spit or a shore bar.

10 MR. ANTHONY: Q. Thank you. I wonder
11 if we could just take a look at the borrow pit operations?

12 MP. SCOTT: Mr. Commissioner, I am
13 sorry to interrupt, but before my friend goes on to lay
14 that to rest, what is meant by the observation as being
15 "re-considered"?
16
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Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams

Cross-Exam by Anthony

Miss Minning's opposite location is being reconsidered. It seems to be inconsistent with Mr. William's answer that there is no need to reconsider it, because it is not what it was said to be. And if it is being reconsidered it might be helpful to know how long it has been under reconsideration.

WITNESS CLARK: One of the basis reconsidering is to evaluate the data that we are collected this past summer. We sampled it and we will be testing it. To that extent it is being reconsidered.

WITNESS MCCART: I am advised and I believe that in the responses of a type of an application assessment, there is an indication that that point, TM47 is on the beach. Perhaps we could in more detailed discussion once both Arctic Gas and I have had an opportunity to track the elusive oil down.

THE COMMISSIONER: Well, at rate, Miss Minning said that I understand the substance of what has been said. On the Arctic coast, from the Alaska-Yukon border to the Mackenzie Delta, the Arctic Gas agrees that it should not use the spits and bars on the coast for gravel. No question about that. Or the beaches.

WITNESS MINNING: That is correct.

THE COMMISSIONER: All right. So you agree that you should not touch the beaches, the bars, or the spits on the Arctic Coast for gravel.

The sources you will be

Clark, Dabbs, Harlan, Hemstock
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Cross-Exam by Anthony

1 using then on the Arctic coast, and I do not think you
2 said this but tell me if I am drawing the right inference
3 The sources you will be using will be essentially the
4 flood plains of those rivers. The Firth, the Babbage
5 and so on that flow north into the Arctic.
6

7 A That is correct.

8 THE COMMISSIONER: And when
9 you come down to the Mackenzie you agree that you will
10 not be using any of the bars in the Mackenzie for
11 borrow? You have just said that. The other thing and
12 tell me if I have got this right. You will not be using
13 you will not be taking gravel from the flood plain of
14 any of the rivers flowing into the Mackenzie?
15

16 A That is correct.

17 THE COMMISSIONER: Okay.

18 MR. ANTHONY: I wonder if I
19 could get an indication from the panel as to the type of
20 environmental protection measures they foresee using
21 in a few specific borrow pit operations and perhaps for
22 ease of reference I will refer to the two that you used ^{Miss Minhin} in
23 your slides yesterday. One of Oscar Creek and the other
24 one at Fort Good Hope. And if I may I would like to
25 refer you to the copy of the slide which we have which
26 shows the final recontoured borrow pit and ask you to
27 expand and perhaps be a little more specific in what you
28 mean in paragraph number 8 where you state that in a
29 situation such as the one described here at Oscar Creek
30 all necessary erosion and drainage control
be employed. Could you tell me what you propose to use

Clark, Dabbs, Harlan, Hemstock
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Cross-Exam by Anthony

1
2 in this instance?

3 WITNESS HARLAN: If I may
4 comment on this. Probably at the upper end, or the
5 upper edge of this, efforts will be taken to divert
6 flow from flowing directly into the borrow area.
7 The drainage ditch for example may be used around the
8 upper edge. At the outflow areas efforts will be
9 made to prevent siltation or sediment from the borrow
10 pit from entering into any water course in the area.

11 The slopes themselves
12 would be at a stable configuration.

13 Q Would you tell me what
14 sort of techniques you propose to use to prevent
15 siltation from a site such as this?

16 A Probably the most effective
17 one which we would use is a siltation pond.

18 Q So you use a drainage
19 ditch above. Would also anticipate using something
20 like a berm at any particular level?

21 A There may be situations
22 where you would want to use a berm.

23 Q Now, have you had an
24 opportunity of testing any of these techniques that
25 you have described in the actual borrow pit operations?

26 A These techniques which
27 I have described are very widely used and very common
28 in all types of construction.

29 Q And you are satisfied that
30 these techniques will operate in borrow pits the size

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 and locality of the ones you proposed to use for this
3 project?

4 A Yes. I am satisfied
5 that.

6 Q You state in paragraph
7 number 11 that the exposed gravel faces which will not
8 be restored or re-vegetated, will be sloped two
9 horizontal to one vertical. And you say gravel face
10 requiring restoration or re-vegetation will be sloped
11 at three horizontal to one vertical. Could you tell
12 me which slopes you propose to restore and re-vegetate
13 and which you propose not to?

14 WITNESS HARLAN: Perhaps Mr
15 Dabbs would like to comment on re-vegetation aspect

16 WITNESS DABBS: I think the
17 choice in this decision as to whether or not to
18 re-vegetate or not relates mostly to the type of mat-
19 erial that would remain in the bottom, on the sides
20 of the borrow pit. That would be in the sense of
21 either rock or pure gravel as the main substrate
22 media. In those cases it is not practical and quite
23 infeasible to re-vegetate rock or gravel. If, however, the
24 materials that remain in the bottom or the sides had
25 a higher proportion of fine-grained materials mixed
26 with the gravel, or in fact might have been a borrow
27 source / that was used for some other reason that was low in
28 gravel content which I suppose in an engineering sense
29 makes it a poor borrow pit, but from our point of view
30 it would be a very easy borrow pit to re-vegetate

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Cross-Exam by Anthony

1
2 in most cases. Then they would be re-vegetated. So
3 the choice is whether or not the material left
4 in the borrow pit is even suitable for the support
5 of plant growth.

6 Q So, as far as re-vegetation
7 as a method of restoration is concerned, it depends
8 on whether it is a subservice that would allow a re-
9 vegetation program to prosper?

10 A That would, I think, be
11 the main consideration. The other however would be
12 if a situation was one where erosion could, for one
13 reason or another, take place and it was important
14 to restore that pit, then as proposed, the surface
15 materials could be and would be salvaged. The
16 organic top soils as it is referred to here would be
17 stripped back, stored and then re-incorporated into the
18 gravel or sand material as a conditioner for the
19 support of plant growth.

20 Q And you recommend that
21 technique in those circumstances where the material
22 that is left would not itself support the plant growth?

23 A Yes, I would.

24 Q Could you tell me what
25 other restoration techniques are available besides the
26 replanting? Do you make any recommendations for other
27 restoration techniques?

28 WITNESS MINNING: Certain
29 bedrock sites which would be below ground level
30 be excavated down might be left as a pond. This is

Clark, Dabbs, Harlan, Hemstock
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one suggestion.

WITNESS HARLAN: One other that
should be added here is the recontouring of the borrow
area.

Q Is this a recommendation
that you have been made ^{and a} proposal that is proposed
to be followed?

A I believe it has been
yes.

Q And, do we have any
indication whether that is in fact is to be followed
particular situations?

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams.
Cross-Exam by Anthony

1
2 WITNESS CLARK: Re-contouring
3 is shown in these illustrated examples, and the vege-
4 tation that you were talking about is the exposed
5 gravel faces, that's the back slopes. They wouldn't
6 necessarily be re-vegetated unless they were erodible,
7 in which case they would be cut to a slightly flatter
8 angle and would be re-vegetated.

9 But the example you're using
10 shows the bottom of that pit to be re-vegetated with
11 -- in the topsoil medium that has been set aside and
12 put back at the end of the operation.

13 Q But you recommend
14 re-contouring of these sites following their abandon-
15 ment as borrow source?

16 A That would be our
17 recommendation. I suspect that ultimately our recommen-
18 dation will be to our client to comply with regulations
19 that are laid down. We won't be able to make the
20 recommendations. What we're trying to do here is to
21 illustrate what we would see as reasonable ways of
22 developing and restoring gravel pits.

23 Q I can appreciate that
24 you will be following recommendations imposed by
25 government or any other authority. I'm really at this
26 stage trying to find out what recommendations you, as
27 an environmental consultant to Arctic Gas, are making
28 about restoration and re-vegetation.

29 A That's really the purpose
30 of the several illustrations we gave in the granular

Clark, Dabbs, Harlan, Hemstock
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Cross-Exam by Anthony

1
2 or borrow related studies report that was completed
3 last March.

4 Q If I can refer you brief
5 then to the proposed development of borrow at Fort
6 Good Hope, you have indicated there in paragraph 8
7 that initial development of the proposed borrow pit
8 will be carried out by extending the excavation of the
9 existing pit. Now, can you tell me whether you have
10 made any recommendations to Arctic Gas about the
11 utilization of existing gravel pits as distinct from
12 searching out and using new pits?

13 WITNESS MINNING: Well,
14 certainly our borrow sources where there are pits a
15 in the areas where there are existing pits, yes.
16 granular material, site 167 on the east of Fort
17 Simpson re-alignment. You saw a picture of that
18 yesterday.

19 Q Have you made any recomm
20 dations with respect to -- are you depending upon your
21 own pits as distinct from creating new gravel pits?
22 I'm thinking in terms now where as a result of maintenance
23 requirements or other new requirements for additional
24 gravel, do you propose then to find the nearest source
25 of gravel to utilize in that maintenance operation,
26 or do you propose to go back to the existing gravel
27 pits and remove further gravel?

28 WITNESS CLARK: That would
29 depend on -- I believe the intent, certainly our intent
30 would be to have anticipated maintenance requirements

Clark, Dabbs, Harlan, Hemstock
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Cross-Exam by Anthony

1 gravel stockpiled by the end of construction at the
2 site where it will be required, with a view to not
3 having to open up new pits at all, or to re-open
4 previously used pits. ~~Now we have~~
5 which we foresaw, then we would go back normally to a
6 pit that had been opened already.
7

8 Q I believe, Miss Minning,
9 you said this morning in response to another question
10 that you 'd recommend and in fact understand that a
11 development program would be prepared for each particular
12 borrow pit site and that it would be approved before
13 the use of the particular borrow site was allowed.

14 WITNESS MINNING: Yes.

15 Q And this development
16 program for each particular site would include details
17 of restoration in each particular case?

18 A Yes.

19 Q And these restoration
20 programs you recommend should include suggestions
21 such as we've had here for the shaping, stabilization
22 and the re-vegetation program.

23 A Yes.

24 Q In circumstances where
25 gravel or borrow has been withdrawn from the pits
26 and proved to be in excess of your requirements, have
27 you made any recommendations as to how this excess
28 borrow was to be disposed of?

29 A Stockpiled at the site
for maintenance.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 Q And therefore it's your
3 intention therefore to allow that gravel to remain at
4 spots throughout the right-of-way rather than return it
5 to the existing borrow site or whatever?

6 WITNESS CLARK: I don't know
7 quite what you're envisioning here. If we had for
8 instance developed windrows of material and it
9 exceeded what we ultimately had to haul, It would be
10 spread out and flattened out as part of the restoration
11 program. I can't see us hauling unintentionally more
12 material than we need. I can see us hauling material
13 say to an air strip and have a small stockpile site the
14 for top dressing and so on through the years. It's
15 quite commonly done in the Arctic.

16 Q I understand it is y
17 intention to use some of these borrow pit sits as
18 sanitary landfill sites for waste disposal. Would y
19 tell me what techniques you propose to use to ensure
20 that a site is not exposed, or to prevent bleaching
21 from causing groundwater pollution?

22 A I'm not aware of any
23 sites that have been designated for sanitary landfill.

24 Q I'm sorry, I believe
25 that's somewhere in the application. If I have a moment
26 I'll see if I can find the particulars.

27 WITNESS WILLIAMS: Bury it deep.

28 Q And what techniques do
29 you propose to prevent bleaching or causing groundwater
30 pollution?

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
CrossExam by Anthony

1
2 A When we're talking
3 about a gravel pit we usually have a depression there
4 and the water would move into the floor of the pit
5 rather than out of it, I think, Mr. Anthony.

6 Q So you're satisfied as
7 a matter of general policy that in fact there would
8 be no bleaching caused by use of borrow pits for
9 sanitary landfill?

WITNESS CLARK:

10 A There's been a very good
11 history of the use of gravel pits for sanitary landfills
12 around urban areas.

13 Q And you propose to use
14 no special -- sorry.

15 A There are techniques
16 that have been developed to prevent bleaching, for
17 example, clay liners that are used. This is the tech-
18 nique that we use in Calgary gravelled areas where
19 there have been sanitary landfills.

20 There's also been extensive
21 monitoring and there are some very good papers that
22 have been written on the migration of different
23 contaminants away from a borrow or sanitary landfill.
24 One that comes to mind is, I believe it was in Idaho,
25 where it was very well instrumented and records had
26 been obtained over a number of years and in essence
27 it proves the techniques that were used to inhibit
28 this to be even more effective than predicted.

29 Q And have you recommended
30 that the use of these clay linings and others before

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 borrow sites are used as disposal sites?

3 A No, we haven't presented
4 any specific recommendations on sanitary landfill
5 sites, because none have been proposed. I'm not sure
6 what you're quoting from, but I think it's probably
7 a general reference that may be used, this type of
8 thing. We would have to deal with that on a site
9 specific case.

10 Q I'm referring to the
11 volume, "Operations and Maintenance, " sorry, the
12 construction plan volume, 13-A.6.7, page 56, where it
13 says that:

14 "Combustible wastes will be burned, other
15 materials will be buried on the right-of-
16 way at stations or other facility sites
17 or at abandoned borrow pits specified
18 by the applicant."

19 A Yes, I have that.

20 Q But as to date you have
21 not specified any particular sites for use as
22 sanitary landfill?

23 A No, we haven't specified
24 any. If required to do that we would accompany it
25 with a site specific assessment and the various techniques
26 to restrict any contamination, if contamination were
27 a concern at that site.

28 Q Perhaps we can turn then
29 to the second mitigative measure you propose in your
30 statement of evidence and that is the use of Arctic

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 construction techniques, and in particular I'd like
3 to turn briefly, if I may, to the question of snow
4 roads and their use on the North Slope. I imagine that
5 you are aware of the argument or variance of opinion
6 as to the advisability of the use of snow roads, or its
7 practicability, and I don't want to necessarily get
8 into that argument. What I would like to turn your
9 attention too, though, is as environmental advisors to
10 Arctic Gas, really to find out whether you are satis-
11 fied in your own mind, as a result of the knowledge that
12 you have that the use of the snow roads on the North
13 Slope will adequately protect the terrain and I gather
14 Mr. Hemstock, that the conclusion, in any event, of
15 your environmental advisors is that the use of a snow
16 road as proposed in the North Slope would adequately
17 protect the terrain from damage.

18 WITNESS HEMSTOCK: Yes, that's
19 so.

20 Q And your assessment of
21 the environmental impact of the construction on the
22 North Slope is based on the understanding that there
23 would not be permanent roads and in fact, ^{there} would be use
24 of snow roads.

25 A That is correct.
26
27
28
29

Clark, Dabbs, Harlan, Herstock,
Koskimaki, McCart, Minning,
Williams.
Cross - Exam by Anthony

MR. ANTHONY: Q Would you agree then that if in fact roads had to be constructed permanent, or semi-permanent roads, that the impact would be quite different and would require some more considerable study?

A Yes, obviously it would be quite different.

Q And your assessment of the adequacy of the snow-road technique, is that based on the Northern Engineering ^{Services} Snow roads Report?

A Not entirely. It is based on that, plus the experience of the producers, plus the experience in northern Alaska. There are several miles of snow-road there.

Q Now, could you tell me what information you have and what purports you are relying on in the ~~use~~ use of snow roads in northern Alaska?

A Relying on the experience basically there of our chief engineer for Artic Gas Mr Jim Trimble ^a who has built several miles of road himself _A

Q Do you have any reports from any environmentalists concerned with the effect to terrain on the use of snow roads in Alaska?

A There is the Battele Report of the Prudhoe Bay, in the Prudhoe Bay area.

Q Have you identified areas which based on your knowledge of a north slope environment where snow harvesting would likely be required?

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams.

Cross - Exam by Anthony

1
2 A I don't think we have identif
3 ied any specific areas.

4 Q Would you recommend that
5 an inventory, or that such an examination be made to
6 ermine whether or not harvesting will be required and
7 where it will be required, whether it is feasible in
8 particular areas?

9 A We have general information
10 the amount of snowfall. I think the difficulty
11 predicting for the year of construction what the
12 conditions will be when you want to begin construction
13 and the alternative you have is to manufacture snow for
14 the snow roads and I personally would prefer that as a
15 method for providing the snow required for the snow-roads
16 over a harvesting operation, although there are
17 areas where harvesting could be done.

18 Q Can you tell me- In
19 recommendations you have suggested that snow harvest
20 be done off land, or off water?

21 A I don't recall that we have
22 made any specific recommendations. We have certainly
23 noted that if the body of water, if it was a harvesting
24 operation off a lake, that we would want to make sure
25 that it was a lake that contained fish, or that if it
26 was, that the extra thickening of the ice would not h
27 an impact on the life in the lake.

28 Certainly the advantages to harv-
29 esting off ice surfaces is that there is no chance
30 kind of damage to the land or the vegetation, or

Clark, Dabbs, Harlan. Herstock
Koskimaki, McCart, Minning,
Williams
Cross - Exam by Anthony

1
2 a concern if you have to harvest off land areas.

3 Q Well, have you done any study
4 ing, or are you aware of any studies done on the effect
5 of snow harvesting on the thickness of ice?

6 A Not specifically on the effect
7 of snow harvesting, but of course there is a lot of liter-
8 ature available on the differences in thickness of ice,
9 between snow covered areas and areas which are blown clear
10 and this kind of information is available.

11 Q I am wondering if...

12 WITNESS DABBS: I just might add one more comment
13 to that. As I was on location during the harvesting of
14 snow off the lake for the construction Inuvik snow-road,
15 at which time I recommended to the engineers that the
16 determine the thickness of ice and monitor that and I don'
17 know that this information was in a report, but I was
18 advised that they were really unable to detect a change
19 in thickness of ice, because it only takes another couple
20 of days and the snow that was removed from the lake is
21 blown back over the lake, so in that one case it was not
22 a measurable change.

23 MR. ANTHONY: Q Dr. McCart,
24 would you perhaps turn your mind to this question of
25 removal of snow off lakes and the effect that might have
26 on the thickness of ice and in particular on the effect
27 on the aquatic environment.

28 WITNESS MCCART: We of course have
29 considered this. Hobbie has, Dr. Hobbie has produced some
30 information on Peter's and Lake in the Arctic wilderness

Clark, Dabbs, Harlan, Hemstock,
Kostimaki, McCart, Minning,
Williams.

Cross - Exam by Anthony

range and he has demonstrated that in years and in areas where there is a minimal snow cover there is of course a thickening of the ice in comparison with those areas that are insulated. so we would expect in general that if snow were removed from an area and if the area remained free of snow for a considerable period of time that there might be a thickening of the ice.

I would point out, however, that obviously you are not going to be taking, or you are probably going to be taking snow from those areas of lakes in which it tends to drift and accumulate and these are the very areas in which a snow cover would be most readily stored.

In addition to that we have recommended that snow should only be harvested from lakes which would freeze to the bottom in any case and secondly that or secondly, from areas of lakes which don't freeze to bottom, ⁱⁿ which are shallows, so that we would recommend picking snow along shore, in bays, in areas where drifts occur, in shallow water areas. let's say where the water depth would be less than four feet. We would expect it to freeze to the bottom in any case.

I don't see it as a significant problem.

Q Provided these recommendations which you have just outlined to us are in fact followed?

A Well, I don't see a significant problem in any case, because I think there are going to be areas in the Arctic in which there are no lakes.

Clark, Dabbs, Harlan, Hemstock,
Kostimaki, McCart, Minning,
Williams.

Cross - Exam by Anthony

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2
3 limited or no snowfall for considerable periods of
4 and that is any lake in which the fish life was to be
5 affected in this way would not have a fish population in
6 any case.

7 Q Go ahead, Doctor.

8 A In other words, it would
9 within the range of natural variation.

10 THE COMMISSIONER: I was just going
11 to say, we might adjourn for a minute for tea and coffee.

12 I just have a question that I
13 postscript to the question I asked you this morning.
14 Dr. Clark, and maybe I could ask it now. at this break
15 in the proceedings.

16 You told me that you had calculated
17 the cost of a pipeline, a gas pipeline buried within a
18 trench, but supported by piles. Presumably the piles
19 be secure in the permafrost and even if the gas was
20 chilled it would, if it melted the permafrost, the piles
21 would hold it secure. That is, I take it, the reason
22 behind it all. You said that would cost two and a half
23 times as much as the buried chilled gas pipeline you
24 propose to build.

25 Did you do any analysis to determine
26 what it would cost in comparison to the buried chilled gas
27 pipeline to build an elevated gas pipeline?

28 WITNESS CLARK: The
29 figures, which as I said was not a rigorous
30 based on the elevated pipeline case and the

Clark, Dabbs, Harlan, Hemstock,
Kostimaki, McCart, Minning,
Williams.
Cross - Exam by Anthony

1 were quoted to me by the people that made the analysis was
2 that it was two and a half to three times as much to do an
3 elevated line as our buried chilled line.
4

5 So, inasmuch as we would have to
6 dig a ditch for the piles and so on, I took the upper end
7 of that, considering three times as much and took the
8 incremental cost and compared that to the incremental cost
9 of building a berm to inhibit frost heave.
10

11 Q So, you were saying then, I
12 didn't realize that this notion hadn't come up until today,
13 at least, I don't think it had, of building the gas pipe-
14 line, running the gas through without chilling, supporting
15 it by piles, piles buried like the pipeline, that would
16 be more costly than the elevated pipeline?
17

18 A Than the elevated pipeline. I
19 would think it would be in that it has much greater loads
20 possible to support, in that it doesn't only have to support
21 the pipe, but there is a load thrown onto the piles by the
22 soil that is thawing out as a result of the warm gas.
23

24 So, perhaps to make that clear. We
25 haven't estimated that cost. The cost we estimated was
26 the elevated pipeline and I extrapolated that to the
27 below ground.
28

29 Q Yes, I am not wanting to be
30 wedded to these figures by any means.
31

32 A No, that's correct, yes.
33

34 THE COURT: I will adjourn
35 for a few minutes then.

Clark, Dabbs, Harlan, Hemstock
Williams
Koskimaki, McCart, Minning
Cross-Exam by Anthony

THE COMMISSIONER: All right,
go ahead, Mr. Anthony

MR. ANTHONY: We're still on the
snow roads, Mr. Commissioner, and I'd like to ask if
someone from the panel, perhaps Mr. Hemstock, would
indicate to me the recommendations you've made or what
stipulations you feel are necessary to ensure terrain
protection on the North Slope when using snow roads?

WITNESS HEMSTOCK: The
obvious one of course is the provision of a thick
enough pavement that there is no failure.

THE COMMISSIONER: Excuse me,
I'm sorry, a thick enough what?

A A thick enough pavement.

Q Of snow?

A Yes, a hardened surface
of snow.

Q No, 'I wished that your
colleagues had used those expressions from the
beginning. It would fill out a story in itself.
But go ahead.

A That is, I think, by
far the most important criteria. Of course, in order
to -- that's inherent in the design of the snow road,
if you get a road that is going to carry traffic and
so on, it is one that will not break down under traffic
and it will therefore protect the vegetation which
underlies the area.

MR. ANTHONY: And what thickness

Clark, ~~Dabbs~~, Harlan, ~~Hemstock~~
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 are you prepared to recommend as the minimum thickness
3 for the use of a snow for the type of equipment that
4 is to be used?

5 A I would think in the order
6 of ten inches of snow cover.

7 Q And do you make any
8 recommendation as to the minimum thickness of the frost
9 layer before these vehicles are to be permitted
10 the North Slope tundra?

11 A I would think that the
12 regulations which are presently in force with the
13 use regulations are probably adequate, and as I
14 they require ten inches of frost, or ten inches of a
15 zen layer. I'd be subject to check on that.

16 THE COMMISSIONER: I heard
17 somebody say eight.

18 A Is it eight?

19 WITNESS WILLIAMS: That
20 Mr. Longden said the other day when he was here.

21 MR. ANTHONY: What type of
22 terrain on the North Slope do you suggest has the
23 greatest potential for damage as a result of the use
24 of snow roads?

25 A I think I'd like to ask
26 Mr. Dabbs to comment on that.

27 WITNESS DABBS: Without daring
28 to pass the microphone back and forth and up and down
29 the table too much, in terrain, I believe our colleagues
30 at the far end of the table are better qualified to

Clark, Dabbs, Marlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1 answer that, but I'm not clear just quite on your
2 question. Would you mind repeating that?

3 Q Well, the question was
4 an identification of the type of terrain that poses
5 the greatest danger, the potential danger for damage
6 as a result of the use of snow roads.

7 A I would pass the terrain
8 part of it down, but I would comment from my point of
9 view on the vegetation associated with that terrain
10 that I think is subject to damage, if not properly
11 cared for. It's been observed and reported in a number
12 of publications and the thesis of one Julios Hernandez
13 that sedge tundra communities are not easily
14 damaged in winter operations because of the position
15 they are in occupying the landscape and the fact that
16 they are generally wet so the operations of equipment
17 even if it breaks through a snow road encounters ice
18 protection. A shrub tundra community which --

19 THE COMMISSIONER: Sorry, what
20 was the next one?

21 A Then the next is
22 shrub tundra, shrub heath tundra, as Dr. Bliss has
23 illustrated to this Commission, are subject to a
24 damage because of the nature of the shrubby plants
25 that stand some foot, two feet above the ground
26 surface, and these are easily broken off if a snow
27 road has not been prepared to sufficient depth to
28 protect them. The other then is the tussock tundra
29 which, due to its great variability in microtopography
30

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 is misleading, as was shown in the slides yesterday,
3 there is considerable depth between the top and the
4 bottom of these tussocks, and they can be easily
5 damaged if not properly -- if the snow road is not
6 properly constructed, and the knocking off of one or
7 two of these tussocks in itself would not be damaging
8 or serious, but any lower than that could result in
9 erosion because they're associated. That type of commu
10 in a broad sense is generally associated with the
11 undulating, smoothly undulating areas adjacent to the
12 foothills on the North Slope, and because of their
13 position in the landscape there is topographic relief
14 which could result in erosion from them, if there
15 damage to them; but in terms of definition of terr
16 units, as your question specifically asks, perhaps
17 could hand it down to Dr. Clark.

18 WITNESS CLARK: Terrain units
19 having a high ice content would be the ones that are
20 -- could be most seriously affected by surface damage.
21 If you wanted to look at a specific terrain unit, the
22 one we classify as R.S.R. on the Arctic Coastal Plain
23 or along the Arctic Coast has a very high ice content
24 and we would consider that to be sensitive to surface
25 damage.

26 Q Could you tell me what
27 studies have been done indicating the effect on the
28 terrain of snow road construction and these type of
29 terrain units?

30 A Yes, there are examples

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1 in reports that we've produced, as well as in the
2 application of geothermal analyses that have been made
3 of the effect of snow roads. There have also been
4 the studies associated with the test roads at Normar
5 Wells and Inuvik.
6

7 Q I understand that there
8 was over this last winter, and ^{/ there} may be currently going
9 on, studies, further studies of the effect of snow
10 roads on terrain. Are you aware of these and involved
11 in these studies?

12 A I'm sorry, there's some
13 background noise that I couldn't quite hear the first
14 part of what you said.

15 Q I understand that
16 last winter season and perhaps currently ongoing there
17 were studies done of the effect of snow roads on
18 terrain. Are you involved in these studies, or are you
19 aware of them?

20 A We're aware of them and
21 are involved with the studies at Inuvik, and there were
22 followup observations made this summer. We also keep
23 in touch with the producers who are constructing snow
24 roads and we have ^{had} discussions with their people as to
25 what they're doing and how they do it, and what their
26 observations are.

27 Q Would you recommend any
28 particular action or treatment of the snow road with
29 respect to rolling or thawing for purposes of creating
30 ice to additionally protect the terrain?

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 MR. MARSHALL: I didn't catch
3 that. I guess it's the band in the background.

4 MR. ANTHONY: I was just
5 wondering, I raised a couple of suggested techniques
6 for terrain protection such as rolling with large
7 diameter rollers and the melting of the surface of
8 the snow road for purposes of creating ice and I'm
9 wondering whether you've considered those recommenda-
10 tions and whether they would be prepared to recommend
11 them to Arctic Gas as a technique to be employed.

12 WITNESS DABBS: I might just
13 make one comment to that. I believe these techniques
14 have been -- were considered when the planning of the
15 Inuvik test was under way. I was associated with the
16 planning of that on-site examination during construction
17 and a post-winter review and I was unable to come up
18 with any recommended construction procedures as you
19 have outlined that would in any way improve what I
20 saw of that Inuvik test, and in my assessment and our
21 subsequent assessment of that test I believe that any
22 snow road built in a similar manner will quite
23 / not only adequately protect the terrain, but the vegetation and
24 organic cover on that terrain.

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Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Anthony

Q Have you considered at all the question of grade and what would be the maximum grade for the snow road in order to adequately protect the vegetation cover?

A The Inuvik test, I was told, of course Les Williams could answer to this, would include the section that had a maximum grade that would be considered for pipeline snow road building and in that case, we found the construction techniques and of course the maintenance which goes along with the operation of the road to be quite adequate to protect the vegetation.

Q Mr. Williams, do you have any information on grade and techniques required to protect the terrain in grade situations?

WITNESS WILLIAMS: The Inuvik snow road did have a slope section that had a 16% grade parallel to the line of the road and another section that had a side slope, I think, of 11%. I do not know if I agree with Mr. Dabbs that this is a maximum --16%--I think it is getting up towards the upper limit but in some cases, it could be steeper than that-- a little. I think we discussed this aspect a bit in one of the responses to a PAAG question.

Yes, I believe we have. I am just reviewing some further aspects of that problem. Would you agree and recommend in at least these places of grade that there be a thicker mat of snow

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Anthony

at the snow road area as compared to a normal level grade?

A I think that would be desirable if the trucks had chain up to get up the grades, It certainly would be more likely to deteriorate more quickly only in that circumstance.

Q Have you done any studies or calculations to determine how the relationship between grade and thickness of snow road?

A No, not beyond what we did at Inuvik where traffic ability studies were run and observations made.

Q Have you made any recommendations as consultants, Mr. Hemstock, as to the maximum weight to be used on snow roads in the north slope?

WITNESS HEMSTOCK: No, we have not. The important factor is not the maximum weight. It is the ground pressure of the vehicles that are using the road. I would rate a conventional gravel truck or probably conventional truck hauling pipes as one of the most severe vehicles on this particular road because of the high tire pressures.

Q Well, the Environmental Protection Board in its recommendation suggested that there not--that ground pressure not proceed psi in order to protect the terrain of the north slope. Do you agree with that type of recommendation?

A No, I would not agree

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Anthony

1
2 with that. In fact that kind of pressure is the kind
3 of pressure that you can use on a protected tundra
4 with snow on it, with low ground pressure vehicles
5 hauling sleighs. Snow roads will handle conventional
6 trucks if they are properly built.

7 Q What, in your opinion,
8 what type of ground pressure could be handled in a
9 type of snow roads that are proposed to be used?

10 A Check with Mr. Williams,
11 but I would guess 80 to 100 pounds per square inch
12 would be--

13 Q And in your opinion that
14 is satisfactory to insure protection of the terrain?

15 A Yes.

16 Q Have you made any recom-
17 mendation as to the time that should elapse between
18 the construction of the snow road and use for that
19 snow road of equipment?

20 A I think that is in the
21 report and it is a matter of aging of snow after it has
22 been milled or treated and the re-crystalization so
23 that it builds up strength. I cannot recall, is it
24 two days, 48 hours?

25 WITNESS WILLIAMS: At Inuvik
26 we put on heavy loads within, at about 24 hours after
27 processing.

28 Q Now, in the spring, as I
29 understand the use of the snow roads, that the ice
30 and the snow below the snow road will melt at a lower

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning,
Williams
Cross-Exam by Anthony

1 rate than the ice along side and the rest of the right-
2 of-way. Have you formulated any opinion or made any
3 recommendations as to how to prevent a rapid runoff,
4 or subsequent erosion caused in the rest of the right-
5 of-way?
6

7 WITNESS HEMSTOCK: Well, first
8 of all, the amount of snow which was required for a
9 snow road is not significantly greater than there is
10 on most of the terrain, so I would not see any great
11 difference in the amount of runoff for a relatively
12 narrow right-of-way.
13

14 Secondly, it depends
15 very much on how the road has been used and what has
16 been hauled on it. If it has picked up any dark
17 material as a result of the usage, it may, in fact,
18 melt more quickly than the surrounding area. I just
19 do not see that that is a problem from the standpoint
20 of thawing in the spring.

21 Q In the Inuvik test faci-
22 lities, did you return after the use of the snow
23 roads were discontinued which I believe was in May of
24 '74 to examine things like runoff and rate of thaw and
25 other environmental effects of the use of snow roads?

26 A I did not. Perhaps Les--

27 WITNESS WILLIAMS: I am sorry.
28 I was looking up the answer to a previous question
29 about tire pressure which I have found if you are
30 interested, Mr. Anthony.

Q Well, go back to that one

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams

first.

A It says, and this is the Inuvik, the Northern Engineering, the Inuvik snow road report. It says while pipeline construction spread loads may run as high as 120,000 pounds gross weight, the ground pressure of these vehicles is not expected to exceed 50 psi. The Kenworth rig and this is the rig which was on the traffic road ability study was run at 80 psi ground pressure to provide a more severe test. Generally the roads stood up very well under traffic and so on.

O As a result of that information and a result of that study, this panel is prepared to recommend that pressures up to 80 psi be allowed on snow roads on the north slope?

WITNESS HEMSTOCK: Yes.

Q It is ^{as} a result of Inuvik test facility test that allow you to make that recommendation?

WITNESS WILLIAMS: That and observations of rig moves in the Mackenzie Delta area.

WITNESS HEMSTOCK: There have also been extensive gravel hauls in the Prudhoe Bay area over snow roads using conventional trucks.

Q This is discussed in that Battele Report that you refer to, is it?

A No, that is a test which is just information that is generally available from

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning,
Williams--Cross-Exam by Anthony

1
2 the operations in the Prudhoe Bay area. I am not
3 aware of any literature on it.

4 Q Mr. Williams, perhaps I
5 can return to you to the other question was if the
6 Inuvik test facility was following discontinuation
7 of the test of May of '74. Was there a re-attendance
8 by any of the environmental consultants to examine
9 runoff patterns, compaction of terrain or any other
10 environmental consequences of those snow roads?

11 WITNESS WILLIAMS: Well, Mr.
12 Dabbs can answer that. I do not think there was a
13 particular study of the runoff pattern, but certainly
14 there was of the vegetation in the summer following
15 construction and again this summer.

16 WITNESS DABBS: It is only--
17 dealing with runoff--there was no instrumentation in
18 the form of weirs as a hydrogologic study. The site
19 was visited daily during the thaw period and simply
20 observations made on the pattern of runoff and not
21 too surprisingly the pattern of runoff matched exactly
22 that of the natural drainage in that area.

23 The other instrumentation,
24 however, which was initially reported and a supplement
25 to the report Mr. Williams just referenced which is
26 an additional report to the Inuvik snow road is one which
27 was written by members of my staff where prior to the
28 construction of the road a number of transects were
29 established, surveyed, both surface elevation survey
30 and thickness of organic material at each of those are

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning,
Williams--Cross-Exam by Anthony

1
2 very points measured , determined. These measurements
3 then were repeated the following season and reported
4 on and they have been again repeated this past fall--
5 the fall of 1975. In addition to the actual measure-
6 ments of the thickness of organic material we have the
7 measurement of the depth of active layer development
8 both on the transects running across the road and
9 there are some six transects, plus controls sites
10 adjacent to the roadway.

11 I could sum up the
12 results very quickly. There has been no measurable
13 change in the thickness of organic cover and there
14 is no statistically significant difference in the
15 depth of active layer development under the--across any
16 of those transects.

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Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 Q Is it the expectation that
3 you will be doing runoff tests and studies to determine
4 the effect on drainage, both sub-surface and surface
5 for the use of snow roads, or has that program now been
6 terminated?

7 A Well, that program is
8 no longer in any form to make such measurements.

9 Q I don't mean you parti-
10 cularly, but is there any studies going on, Mr. Hemstock,
11 at all to follow up the studies so far conducted on the
12 effect of snow roads on drainage , both surface and
13 sub-surface drainage in different terrain types?

14 WITNESS HEMSTOCK: No, there have
15 been no studies that I am aware of in Canada on behalf
16 of Arctic Gas. We will be doing some observations of
17 snow roads in Alaska in this coming winter.

18 Q I'd like to move then, if
19 I may, to a question of clearing. In 11 in your evidence
20 you indicate that you will be using hand clearing and
21 I imagine too that you will be using this at all times
22 of the year, is that the expectation?

23 WITNESS WILLIAMS: Clearing of
24 the right-of-way itself, if hand clearing is used I
25 would see it, I think we've suggested several times that
26 it be done in the summer and fall before there is a --
27 rather than winter when the snow is deep, it's just
28 awkward. close-cropping short stumps in the
29 wintertime. Now that doesn't mean that in some areas
30 maybe in development of borrow pits or something like

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 this that hand clearing could be done in the winter
3 but not the bulk of it along the right-of-way.

4 Q Have you formulated any
5 environmen_tal guidelines as to the situation that
6 should exist before you would allow anything other than
7 hand clearing to take place?

8 A Now we're talking about
9 areas of sensitive permafrost, are we, Mr. Anthony, or
10 anywhere?

11 Q Well, we can break it
12 down. I'm dealing generally with the guidelines that
13 you would recommend in any cle_aring in any situation,
14 What circumstances are you going to demand hand clear-
15 ing?

16 A We would recommend it
17 in areas of sensitive permafrost that hand clearing
18 be undertaken. We have recommended it.

19 Q Would you also recommend
20 hand clearing in all cases where there is large
21 trees to be uprooted?

22 A No, not in Northern
23 Alberta, for instance, or south of Fort Simpson in non-
24 sensitive areas, unless there is a requirement for the
25 timber, if it's merchantable and somebody wants it,
26 and this is not always the case. In lots of pipeline

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams

Cross-Exam by Anthony

1
2 Q Is it your intention to
3 remove all merchantable timber along the right-of-way?

4 A To remove it, to cut it,
5 yes.

6 Q Cut it and stack it, to
7 harvest the wood.

8 A With that qualification,
9 I think, that if it's going to be used, by all means
10 stack it so it's convenient to be hauled away. If
11 nobody wants it, I think the Forestry Department would
12 probably prefer that it be burned.

13 Q Would you recommend that
14 all those areas that are not to be utilized beyond
15 clearings, I'm thinking now in terms of approaches to
16 runways and so on, that those should be hand-cleared?

17 A In sensitive areas, yes.
18 Sensitive permafrost areas.

19 Q Beyond those areas of
20 permafrost you referred to, you have no objection for
21 environmental reasons to the use of mechanical clearing?

22 A Did I understand you,
23 out of these sensitive permafrost areas? No.

24 Q Areas of permafrost, have
25 you outlined any criteria or minimum conditions that
26 must exist before the use of mechanical clearing?

27 A Yes , it's certainly best
28 done probably after the 1st of January when the frost
29 has penetrated deep enough to freeze the roots in,
30 and the trees then can be sheered off at ground level

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning
Williams

Cross-Exam by Anthony

1 without tearing up stumps.

2 Q And do you have any
3 recommendation as to minimum snow cover before using
4 mechanical clearing?

5 A No sir. The snow is
6 going to go with the timber off the right-of-way.

7 Q But as far as protection
8 of the terrain is concerned, do you feel that there is
9 any minimum snow cover required in those permafrost
10 areas before you should allow mechanical clearing?

11 A I think if you wait till
12 January there is going to be some snow cover.

13 Q But you yourself have no
14 idea as to what snow cover would be the minimum required
15 in order to protect the terrain.

16 A No, and if we're talking
17 about non-sensitive permafrost areas, then I don't
18 think we have quite as big a concern about the vegeta-
19 tive cover as in the sensitive permafrost area.

20 Q Well let's deal then with
21 the sensitive permafrost area. Have you formulated
22 any guidelines there as to minimum snow cover?

23 A It's pretty difficult to
24 clear with a machine and not also move the snow with
25 it, Mr. Anthony, if you're going to close-crop the
26 trees to near ground level, the snow is going to go
27 with the trees.

28 Q If in fact using bulldozers
29 you are going to scrape the snow off to the ground level,
30

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1 does that in your mind not create potential environ-
2 mental dangers in mechanized clearing?

3 A This is the way it's
4 done in Alberta all the time, and except for special
5 measures on the slopes I don't think it's serious.

6 Q I believe that the
7 Environmental Protection Board in its study suggested
8 that in all areas north of the 65th Parallel, all
9 machine clearing should be carried out in the winter
10 previous to construction in that area, and I believe
11 also that the Pipeline Application Assessment Group in
12 some of its comments suggested that clearing take
13 place immediately in advance of utilization of the area.
14 Can you tell us what studies you've done and what
15 conclusions you have come to as to clearing and
16 utilization of the area for construction?

17 A If one opted -- and
18 we're not recommending it -- but if one opted to do
19 machine clearing in sensitive permafrost terrain, then
20 it should be done a year ahead of construction because
21 I don't think it should be done until January, and in
22 the year of construction, that's too late.

23 Q Now with respect to the
24 slash and debris on the right-of-way, I interpret your
25 application that you propose to burn that off at
26 suitable times throughout the year.

27 A Yes sir.

28 Q And would you recommend
29 in those cases that the use of sleds or racks have
30

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

surfaces for burning to prevent subsidency to
thawing?

A Yes sir.

Q Now, I believe
/ also in your applica-
tion it's recognized that clearing around water courses
is a particularly critical area. Have you made any
recommendations for protection measures in dealing
with the crossing of water crossings?

A Yes, we've witnessed the
clearing on the Mackenzie Highway where the trees have
been left on the banks of the rivers and creeks until
immediately ahead of construction, and we think that
the pipeline operation could be done the same way.

Q Now do you intend also
to do some logging for timber beyond the right-of-way?

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams.

Cross - Exam by Anthony

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2
3 WITNESS WILLIAMS: For airstrips and
4 compressor station sites and access roads and borrow
5 sites, but do you mean just for the taking of timber for
6 some other use on the right of way? No sir. That is not
7 in the plan.

8 MR. ANTHONY: Q You would
9 anticipate that all your timber requirements can be met
10 from merchantable timber found on the right of way
11 on the areas that you are clearing, or brought in?

12 A No, I don't think there is
13 anything in our plan to use merchantable timber on the
14 pipeline construction to any great extent, Mr. Anthony

15 In the southern end where corduroy
16 may be required. It's possible, but not very likely.
17 In the muskeg area we would plan to induce frost into the
18 muskeg early in the winter to avoid the necessity of
19 having to put down corduroy, if that is what you had
20 in mind.

21 Q Your expectation is that
22 whatever requirements you might have they can be met
23 without doing any logging beyond your right of way?

24 A Yes, sir.

25 Q One other point you mention
26 with respect to Artic construction is found on page 22
27 at the bottom of 22 and the top of 23, where you state
28 "It is further recognized that under extreme conditions,
29 liquification, or a zero effect of stress conditions may
30 be induced resulting in a large amount of settlement."

Clark, Dabbs, Harlan, Hemstock,
Foskimiaki, McCart, Manning,
Williams.
Cross - Exam by Anthony

1 bearing capacity." You go on to say that, "techniques are
2 available to take these features into account during the
3 final design of the pipeline." I wonder if you could tell
4 me what these techniques are?
5

6 WITNESS CLARK: This relates to
7 slope stability.

8 Q I think it is dealing with
9 thawing in frozen soils. This is on page 22, the effect of
10 warm pipeline operation on thaw settlement?

11 A Yes, yes. What is referred to
12 here is the potential for excess pore pressure to develop
13 in a thawing slope. In other words, the slope is thawing
14 more quickly than it can drain and in that circumstance
15 the slope stabilization measure would be to install a
16 means of, to provide a means of relieving pore pressures
17 and there are several techniques which will do this.

18 A common one is sand drains or
19 wicks. You give the water a shorter path to get out by
20 means of a small diameter hole that is drilled in the
21 ground and it is filled with sand. That is the liquef-
22 action, or a zero effect of stress condition. It's a
23 drainage of the slope.

24 Q It is really an attempt then
25 to prevent this from occurring, rather than constructing
26 or operating with that condition?

27 A Yes.

28 Q I would like to look then
29 next at the question of re-vegetation and Mr. Dabbs, in
30 your evidence at page eight and then in answer to questions

Charles L. Bell, Harlan, Hemstock
Ordinahl, McArt, Minning,
Williams.
Cross - Exam. by Anthony.

from Mr. Hollingworth you indicated that you expect an effective vegetation cover in four to five years and "effective" there was defined in terms of preventing erosion in other words the physical erosion. Am I correct in that understanding?

WITNESS DABBS: Yes.

Q And in fact, you have indicated through Appendix "C" to your evidence there that the prevention of physical erosion is in fact the objective of this re-vegetation program?

A That is the first objective, yes.

Q And are you also concerned about thermal erosion?

A Yes we are concerned.

Q And could you tell me about the use of this criteria in selecting a re-vegetation regime?

A You could take a look at what could be expected from any re-vegetation process. I think it is a popular misconception that re-vegetation can create miracles and prevent thermal degradation, because, naturally, the organic living and dead organic matter maintain any particular site, in certain thermal regime, a thermal balance. Consequently permafrost exists and continues to exist and the extrapolation then a re-vegetation program can come along and re-establish plant cover that in itself, in a short term, will also

Clark, Dabbs, Harlan, Hemstock.
Koskimaki, McCart, Minning,
Williams.
Cross - Exam. by Anthony

1
2 re-establish thermal regime, thus resulting in the
3 restoration of perma-frost to a pre-construction condition
4 is, just as I said, a popular misconception.

5 Now, putting that into some per-
6 spective. I believe, and we have stated all along, that
7 re-vegetation in combination with a chilled pipeline will
8 in fact restore^a perma-frost table to near, or perhaps
9 even above, as Dr. Harlan has discussed, the pre-construction
10 condition and this is due largely due to the influence of
11 the existance of the chilled gas pipeline. However, the
12 instrumentation at Sans Sault, which have been reported on
13 in Volume 11 of this progress report here shows that blank
14 cover in plots instrumented does in fact have quite a
15 significant influence on the heat energy input to the
16 soil, so re-vegetation does effect the amount of heat
17 energy absorbed in the soil.

18 THE COMMISSIONER: Well, it absorbs
19 a certain amount of heat energy that would otherwise, if
20 there were no re-vegetation penetrate the ground and retard
21 the restoration of perma-frost conditions. Is that the
22 point?

23 A Yes, sir. The instrumented
24 plots that have been kept bare of all plant cover have
25 shown significant input of heat energy over the seasons
26 whereas those plots that have a grass cover, re-seeded,
27 have significantly reduced the amount of heat
28 energy input.

29 Q But the vital thing in terms
30 of the Artic Gas proposal is the presence of the chilled

Clark, Labby, Carlan, Hemstedt,
Koskimaki, McCart, Minning,
Williams.
Cross - Exam by Anthony.

gas pipeline, that is what will restore the perma-frost
table?

A That is what will restore it in
the short term, yes, sir. The statement has been made in
the application and I simply attempted to clarify it here,
the re-vegetation and the chilled pipeline will restore
the perma-frost table. In the short term it is the gas
pipeline itself that is doing that

MR. ANTHONY: O What about those
areas beyond the influence of the chilled pipeline, beyond
the ^{frost}bulb around it, but within the right of way that has
been cleared? How do you propose to prevent thermal
erosion in those areas?

A With the construction of the
type of snow-road that has been under discussion. inasmuch
as that type of construction will protect the insulative
ground cover. Now, naturally it is shown in our reports,
It is there for all to see, but there is an increase in
active layer depth on the right of way, but beyond the
influence of the chilled pipeline.

That increase in active layer depth
is in no way comparable to the increase in active layer
depth which takes place without ^{the} pipeline. When that test
site at Sans Sault was shut down there was an increase
in depth of active layer in the seeded plot over the pipe-
line. It is shown in the graphs in this report, whereas,
with no treatment at all, but on the right of way, the
increase of active depth, there is an increase. but it
is not a serious one, so the technique clearly is a good

Clark, Dabbs, Lantieri, Berntson,
Koskimaki, McCart, Minnino
Williams.

Cross - Exam. by Anthony.

snow-road.

Q From your point of view you are satisfied that beyond the area of the frost bulb there is no need to take, to plant, or to take other measures to prevent thermal erosion?

A The only situation there - Of course the principle technique is to maintain nature's own insulative cover. Now, of course in the warm permafrost regions the removal of the tree cover in itself will initiate degradation and it is not possible to compensate for that with any negative measure.

In the case where an accident may take place, the snow-road breaks through, the area would be seeded, or if that happened to be on a slope, then additional measures would have to be used to prevent erosion from that spot.

Q You state further on page 26 that some shrubs and trees will be allowed to re-establish themselves along the pipeline. Is it your intention to allow the regrowth of shrubs and trees during the life of the pipeline?

A I believe as a basic approach this is what Artic Gas intends. However, I also would believe that there will be sites where access to the right of way will require the control of shrubs. Those sites I would anticipate being very few in number and very few in extent, as the recovery of trees in latitudes north of 60 is very slow, as is clearly shown by the age and the small size of the trees.

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

Q So that I understand this correctly, the basic intention is to allow the re-growth of trees and shrubs onto the right-of-way.

WITNESS DABBS: Trees and shrubs, from my point of view, are part of the natural community which would be promoted for re-establishment.

Q And in some areas you feel it will be necessary to restrict this re-vegetation. What areas are you thinking of?

A I wasn't myself thinking of any specific areas. I was simply stating that I believe that there may be occasion when access to the right-of-way is maybe required, and in those cases such as near a river crossing, for inspection, the recovery of willows in 15 years is going to be sufficient that if there is a need for, and other engineering reasons, to be able to see that crossing for one reason or another you may have to restrict the growth of willows because they are very fast-growing.

Q Let's deal with that example then, of the willows in and around crossings, water crossings. Now is it the intention to remove the willows on a continuing process, or are they be allowed to re-grow and just be removed in cases of emergency.

A I would think they would be allowed to grow to the point where someone would identify a need to gain access to that area, or to be able to see it as part of the normal maintenance surveillance. Removal in this case would not be continuous, simply

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1 cutting them back once in a lifetime of the pipeline
2 is probably all that will be required.
3

4 Q So to that extent the
5 right-of-way will be continued throughout the life of
6 the pipeline to be cut back.

7 A If there is a need to
8 seed or gain access.

9 Q Do you anticipate or
10 do you expect the need to spray the pipeline right-of-
11 way in any way to retard growth?

12 A No, I don't. It's a
13 stated policy of Arctic Gas, perhaps Mr. Hemstock could
14 speak to it, that herbicides would not be used north
15 of 60 for the control of shrubs and trees, and as I
16 said earlier, I think it's a simple matter of hand-
17 cutting shrubs in the limited areas that might be
18 required only once in a lifetime of the pipeline.

19 Q In your slide presen-
20 tation yesterday you described the return of native
21 grasses in the area that you depicted in those slides.
22 So I understand that term correctly, by "native grasses"
23 you don't mean necessarily grasses that were there
24 before, but grasses that are not introduced or foreign
25 species brought in and planted. Is that accurate?

26 A That's close. I think
27 what they should be viewed as, and in fact are, pioneer-
28 ing species, as part of the normal or natural succession-
29 al process there are certain species that invade
30 disturbances whether they're man-made or natural

Clark, Dabbs, Harlan, ~~McCart~~
Koskimaki, McCart, Minning
Williams

Cross-Exam by Anthony

1 that are subsequently replaced by others in the process
2 of development of a plant community. Those first
3 ones are generally referred to as pioneering species.
4 They are often difficult to find in a climaxed community
5 but they exist, and they are there all the time.

6 Q And would you expect that
7 the same pioneering species would re-occur throughout
8 the length of the pipeline?

9 A Oh, it's quite a variable
10 situation. There are several species that are clearly
11 most prominent pioneering species, right from Northern
12 Alberta to the Tuk Peninsula, and those are the two
13 natives that have been discussed in relation to our
14 native seed increase program.

15 Q Have you had occasion
16 to study the effects of ponding or standing water on
17 your re-vegetation program?

18 A Limited occasion. As
19 the one shown in the photograph yesterday of just
20 test section 4 at San Sault in one low area there was
21 minor ponding of a few inches of water and is shown
22 there, natural recovery is faster than seeded recovery
23 and in fact the best re-vegetation taking everything
24 collectively takes place around small ponded areas.

25 Q I believe that's what
26 your picture indicated, that around those areas there
27 was rapid re-vegetation. What about in those areas
28 underneath the water?

29 A Well, if a pond is
30 allowed to get deep enough, of course, those -- the

1 number of species that are adapted to that are limited,
2 there are very few pioneering rooted aquatic macrophites,
3 as the term is used, and consequently there is very
4 little growth of emergent vegetation if the pond gets
5 that deep.
6

7 Q But would you agree with
8 me that mosses and lichens in particular are easily
9 killed by any form of flooding?

10 A Well, terrestrial mosses
11 and lichens are, but then of course there are aquatic
12 mosses that are promoted by such situations.

13 Q So if there was a season
14 where ponding had resulted from icing over the winter,
15 would you expect that in that area the re-vegetation
16 program would be retarded or in fact eliminated?

17 A I think perhaps I could
18 agree with the term "retarded". I wouldn't think it
19 would be eliminated.

20 THE COMMISSIONER: Mr. Anthony,
21 would this be a convenient point to adjourn?

22 Q This business Mr. Anthony
23 was asking you about this morning, Mr. Dabbs, the
24 agronomic re-vegetation and the natural re-vegetation
25 -- am I using the expressions correctly? Can you
26 tell me, as I understood it, you were talking about
27 imported species and varieties when you spoke of
28 agronomic re-vegetation. I thought the purport of
29 the discussion that you had with Mr. Anthony was --
30 and with Mr. Hollingworth, yesterday, was along those

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 lines. That is species and varieties not presently
3 found in these latitudes. Now can you tell me in point
4 form why you -- what is the advantage -- if you want to
5 leave it till tomorrow it's fine with me, but if you
6 can do it now, that's fine, why you want to bring in
7 these species and varieties that are not indigenous
8 to these latitudes?

9 A Well, sorry that we're
10 functioning on this panel in the absence of the testi-
11 mony which I have prepared for Panel 3, which I - or
12 Phase 3, which I go into several pages of in my
13 testimony on the very topic of the introduction of
14 species, the definition of exotic species, and the
15 threat that is posed by the introduction of species that
16 are not native to an area irrespective of whether
17 we're speaking of the north or experiences throughout
18 the world in plant geography, --

19 Q It's like introducing
20 rabbits to Australia, sort of thing.

21 A -- that, I believe, is
22 the concern and legitimately so, that people have with
23 the use of species and varieties that are referred to
24 as agronomic, and personally I had the same concern
25 when we started this program some five years ago.
26 The initial research by people like Dr. Bliss and our-
27 selves, Dr. Mitchell, included as wide a range of
28 varieties as we were able to obtain at the time, and
29 our research in subsequent years has included additional
30 varieties for test to determine which of the available

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 varieties or species do perform and will provide and
3 meet the objectives set in re-vegetation programs.

4 Now during the course of that
5 past five years we found a number of species that
6 have failed. They may establish in the first year,
7 and they are simply unable to tolerate the long
8 cold winters that you have here, and are eliminated.
9 Those that have been successful continue to grow and
10 meet the objectives set, are not too surprisingly those
11 that are either direct selections of species indigenous
12 to the north of both Canada and Alaska, or those that
13 are very closely related to those species, the flora
14 of the Northwest and Yukon Territories.

15 Consequently the results of
16 re-vegetation studies by everyone involved as summarized
17 in Table 1 of my Appendix "C" , indicates that the
18 successful agronomics are those that have been selected
19 from either natives or species that were introduced
20 into North America and have gained certain polar
21 distribution, as much as 50 to 200 years ago, since
22 colonial times there have been hundreds of species of
23 plants introduced to North America, and some have been
24 successful in extending their range slightly and almost
25 without exception are associated with disturbances such
26 as the Mackenzie River. The Mackenzie River has for the
27 past 200 years carried north seed from agricultural
28 lands draining into its water shed, and has distributed
29 these throughout the entire Western Arctic, and only
30 those that are adaptable to the situation have the

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1 genetic potential' for survival in the Arctic still
2 persist along the river in disturbed sites generally
3 associated with human activities.
4

5 So the results of our work
6 have shown, and they are now part of our specifications,
7 that the species proposed for use are those that have
8 been selected, as I said, from natural or native
9 species or those that have been successful in colonizing
10 north temperate latitudes. In themselves have demon-
11 strated that they do not possess the rabbits indigenous
12 to Australia syndrome, and ourselves and in further
13 testimony I believe will expand on this and show, sir,
14 that fear is no longer founded, and --

15 THE COMMISSIONER: That is
16 no longer well-founded?
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Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

A No longer well-founded,
and subsequent research in the past few years have also
shown that the fact that the species involved in our
experimental work, I think Hernandez being the
principal author in this case do not have the
competitive capability of expanding into established
closed climax plant communities.

THE COMMISSIONER: Thank you
very much. We will no doubt be hearing more about
that. Well, we will adjourn then until 9:00 tomorrow
morning.

(PROCEEDINGS ADJOURNED TO NOVEMBER 5, 1975)

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Vol. 80

AUTHOR

Mackenzie Valley pipeline inquiry:

TITLE

Vol. 80 4 November 1975

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IN 2085

Hamilton

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Vol. 80



MACKENZIE VALLEY PIPELINE INQUIRY

Government
Publications

IN THE MATTER OF APPLICATIONS BY EACH OF

- (a) CANADIAN ARCTIC GAS PIPELINE LIMITED FOR A RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS CROWN LANDS WITHIN THE YUKON TERRITORY AND THE NORTHWEST TERRITORIES, and**
 - (b) FOOTHILLS PIPE LINES LTD. FOR A RIGHT-OF-WAY THAT MIGHT BE GRANTED ACROSS CROWN LANDS WITHIN THE NORTHWEST TERRITORIES,**
- FOR THE PURPOSE OF A PROPOSED MACKENZIE VALLEY PIPELINE**

and

IN THE MATTER OF THE SOCIAL, ENVIRONMENTAL AND ECONOMIC IMPACT REGIONALLY OF THE CONSTRUCTION, OPERATION AND SUBSEQUENT ABANDONMENT OF THE ABOVE PROPOSED PIPELINE

(Before the Honourable Mr. Justice Berger, Commissioner)

Yellowknife, N.W.T.

November 5, 1975.

PROCEEDINGS AT INQUIRY

VOLUME 81

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E R R A T A

CANADIAN ARCTIC RESOURCES COMMITTEE:

P. 11906, l. 12

MR. ANTHONY: I am advised, and I believe that in the Responses to the Pipeline Application Assessment Group, there is an indication that that site, TM-47, is on the beach. Perhaps we could have a more detailed discussion once both Arctic Gas and I have had an opportunity to track down the elusive borrow site.

P. 11915, l. 29 - "bleaching" should be "leaching"

P. 11916, l. 8 - "bleaching" should be "leaching"

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APPEARANCES:

Mr. Ian G. Scott, Q.C.	
Mr. Stephen T. Goudge,	
Mr. Alick Ryder and	
Mr. Ian Roland	for Mackenzie Valley Pipeline Inquiry;
Mr. Pierre Genest, Q.C.	
Mr. Jack Marshall,	
Mr. Darryl Carter, and	
	for Canadian Arctic Gas Pipeline Limited;
Mr. Reginald Gibbs, Q.C.	
Mr. Alan Hollingworth	for Foothills Pipelines Ltd.;
Mr. Russell Anthony,	
Prof, Alastair Lucas	for Canadian Arctic Resources Committee;
Mr. Glen W. Bell and	
Mr. Gerry Sutton	for Northwest Territories Indian Brotherhood and Metis Association of the Northwest Territories;
Mr. John Bayly	for Inuit Tapirisat of Canada and the committee for Original Peoples Entitlement;
Mr. Ron Veale and	
Mr. Allen Lueck	for the council for the Yukon Indians
Mr. Carson H. Templeton	for Environment Protection Board;
Mr. David Reesor	for Northwest Territories Association of Municipalities
Mr. Murray Sigler	for Northwest Territories Chamber of Commerce

I N D E XPage

WITNESSES FOR CANADIAN ARCTIC GAS PIPELINE LIMITED:

John Ivor CLARK	
Donald L. DABBS	
R.L. HARLAN	
R.A. HEMSTOCK	
C.M. KOSKIMAKI	
Peter J. McCART	
Gretchin V. MINNING	
Guy Leslie WILLIAMS	
- In Chief (cont)	11958
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- Cross-Examination by Mr. Bell	12016
- Cross-Examination by Mr. Bayly	12022

EXHIBITS:

306	List of Reports Relied on by Dr. Roed	11961
307	6 Articles re laying pipelines below bodies of water	11961
308	Abstracts of papers, "Deep Water Pipeline Techniques" & "Laying Stress Calculated in Deep Water Pipelines", both Sept.74	11961

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning
Williams
In Chief
Yellowknife, N.W.T.

November 5, 1975.

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR. MARSHALL: Mr. Commissioner,
perhaps before cross-examination recommences, I should
deal with two matters that came up yesterday, Miss
Minning was asked about the location of a particular
borrow site near Shingle Point, I believe its designation
is GM-47, and she's obtained some information as to the
location of that site and she'd like to put that on
the record, if she may.

JOHN IVOR CLARK,
DONALD L. DABBS,
R.L. HARLAN,
R.A. HEMSTOCK,
C.M. KOSKIMAKI,
PETER J. McCART
GRETCHEN V. MINNING

GUY LESLIE WILLIAMS, resumed:
DIRECT EXAMINATION BY MR. MARSHALL (CONTINUED):
WITNESS MINNING: The dot

which appears on the strip map is in a gravel deposit
which is in the bank behind the beach at Shingle Point.
It is presently being used by an establishment at
Shingle Point. We are re-considering the site, perhaps
because we won't be allowed to use the site by the
facility itself. There is a good deposit that is
three miles south and four miles west of Shingle Point
that was found this summer on our program.

MR. MARSHALL: Sir, the other
matter pertained to Table 2 that was contained as
Appendix "C" in the direct evidence of the panel. The
appendix was a report prepared by Dr. Younkin of N.E.S.,

Clark, Dabbs, Harlan, Hemstock
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Williams
In Chief

1 and Mr. Hollingworth was asking Mr. Dabbs a number of
2 questions pertaining to it, and it became apparent there
3 were a number of errors in the table. We've had the
4 table re-typed and I've circulated it to the counsel.
5 I believe Mr. Bell wasn't here, I'm not sure whether
6 he's arrived yet or not. In any event, I have additional
7 copies of it and I think I'd like Mr. Dabbs to go over
8 the revised table and he can explain how the problems
9 arose. Mr. Hollingworth then may want to ask him some
10 questions about it. I have a copy for you, sir.

11 MR. HOLLINGWORTH: Thanks.

12 MR. MARSHALL: And I'd like
13 to have the report itself as an exhibit.

14 Mr. Dabbs, do you have any
15 comments about the revised Table 2 that has just been
16 entered as an exhibit?

17 WITNESS DABBS: Yes, I have.
18 I'd like to start by apologizing for the delay that
19 these errors have caused to this Inquiry and to
20 briefly run down the changes that have been made.
21 As you might guess when I confronted Dr. Younkin on the
22 phone of these errors, he was rather surprised that the
23 copy of the table that he and I ^{reviewed} last week did not
24 contain these errors.

25 The first correction is
26 initial seeding of Arctic tundra high erosion potential
27 The two species ^{that} are reversed are Arctared creeping
28 red fescue at the rate of 38 kilograms per hectare,
29 with the nugget at about 18.

30 The next change then

Clark, Dabbs, Harlan, Hester, J.
Koskimaki, McCart, Mianir,
Williams
In Chief

forest tundra, high erosion, the meadow foxtail
typing error there, It should have been 11 kilogram
instead of the 22.

In the medium erosion
of forest tundra, egmo timothy and the boreal creeping
red fescue were reversed on the original table,
similarly the two species, varieties were reversed
low erosion.

The other correction under
initial seeding then is the low erosion boreal forest
where the boreal creeping red should have read
kilograms per hectare.

Now some of the questions
were asked yesterday did relate to the followup
and why there was a reversal of species and rates
and the fact of the matter is all four seed combinations
for low Arctic tundra and forest tundra should be
same, emphasizing then the Arctic creeping red
fescue, which has proven to be the better of
species involved here.

For clarification of everyone
here, trying to read this table, of course everyone in
this country is attempting to convert to metric
these numbers read somewhat odd as they are a conversion
from pounds per hectare to kilograms per hectare,
seems strange to view uneven numbers as these appear.
The basic premise is one that approximately 50 pounds
per acre total seed would be used in the high
medium erodibility areas, both the low Arctic and forest

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
In Chief

tundra areas -- sorry, for all three areas, with a substantial reduction in the rate of initial seeding in the low erodibility areas.

There was a question yesterday also why nugget Kentucky bluegrass did not appear under the initial seeding on medium erosion potential low Arctic tundra, and the rationale here is one of Arctared, as I mentioned before, has proved to be the better of the two varieties; consequently emphasis in all of the seed combinations in this particular case it is felt that initial erosion control would be provided by Arctared. The other three species provide the genetic diversity to cope with the range of conditions, micro-habitat conditions that will be present on a backfill mound and again for clarification for those who are wondering why there is such a reduction 6 kilograms per hectare from the 40. These three varieties, species have proven to produce a relatively high ground cover at these lower rates of seeding, consequently they have been reduced in their initial rate of seeding.

(LIST OF REPORTS RELIED ON BY DP. POND MARKED EXHIBIT 306)

(6 ARTICLES RE LAYING PIPELINES BELOW BODIES OF WATER MARKED EXHIBIT 307)

(ABSTRACTS OF PAPERS, "DEEP WATER PIPELINE FOUNDATIONS", September 1974, and "STRESS CALCULATED IN DEEP WATER PIPELINES", September 1974 MARKED EXHIBIT 308)

Clark, Dabbs, Harlan, Herstock
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Williams
Cross-Exam by Anthony

I think that reviews the
corrections.

MR. MARSHALL: Thank you
very much, sir.

CROSS-EXAMINATION BY MR. ANTHONY CONTINUED:

MR. ANTHONY: I wish to proceed with cross-examination on two things. One, I would like to submit as exhibits some material that Dr. Roed referred to when gave evidence. You recall that as a result of questioning, I believe, from Mr. Marshall. He undertook to file a list of the reports within the Environmental Social Program that he used and relied on in his appendix on alternate transportation routes and corridors and I have a list of those reports.

In addition, he also referred to a number of articles dealing with the problems of laying pipelines below bodies of water and I have six articles from various journals, professional journals outlining these techniques and commenting on these techniques.

In addition to that, there are two abstracts of papers presented at technical conferences. One is entitled "Deep Water Pipe Laying Techniques Improved" by a firm of engineers in the Netherlands, which was presented to the Technology Off-shore North Sea Conference in Norway in September, 1974. And the other one, an abstract of a paper presented to the Petroleum Mechanical Conference in Dallas in September of 1974 entitled "Laying

Clark, Dabbs, Harlan, Hemstock
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Williams
Cross-Exam by Anthony

1 Stress Calculated in Deep Water Pipelines." So those
2 abstracts plus the six other reports and articles are
3 also going to be tabeled as undertaken by Dr. Roed.
4

5 In addition, I wonder if
6 I may get a word of clarification from Miss Minning
7 on this shingle Point borrow site so that I understand
8 the current position with respect to use of that site.
9 Do I understand that you intend to use the bank behind
10 the beach? Is that the ^{present} alternate source?

11 WITNESS MINNING: That is
12 correct and it is the site that has already been used
13 by the facility at Shingle Point.

14 Q And, you stated, I believe
15 it is your intention then to use that site unless you
16 are prohibited from using it for some reason.

17 A That is correct.

18 Q And, you have at this
19 presence no environmental objection to use of those
20 sites and you intend to prove its use in environmental
21 terms unless prohibited by someone else.

22 A That is correct. We are
23 also doing some tests on the materials on the deposit.

24 Q Sorry, I--

25 A We are also doing some
26 tests for quality on that particular deposit.

27 Q From environmental terms,
28 there is no objection to use of that site by Arctic
29 Gas?

30 A It is certainly one we

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1
2 would want the bird consultants to look at very closely
3 before using it. That is one reason it is not a
4 preferred site.

5 Q You indicated also
6 that it would not be used if it was prohibited. Can
7 you explain why it is expected that it may be
8 prohibited and by whom?

9 A The people at Shingle
10 Point who are already using it.

11 Q Okay, I would like to
12 continue, Mr. Commissioner, then with the few questions
13 that were remaining to Mr. Dabbs on the question of
14 re-vegetation. You outlined in your evidence the use
15 of aerial technique for seeding of the right-of-way.
16 Could you tell me what time of year, or if there are any
17 critical times for this program?

18 WITNESS DABBS: Excuse me. In
19 the evidence it reads that following winter construc-
20 tion right-of-way the backfill mound pipelines will
21 be seeded and fertilized in the appendix C, section
22 headed "Implementation" as I discussed briefly in my
23 slide presentation. I am now considering seriously the
24 application of most of the seed and fertilizer during
25 the winter months as the last operation following
26 right-of-way clean up.

27 Following that, then
28 the spring period following, of course, the winter
29 construction season, any additional seeding and
30 seeding treatments of slope would be undertaken with

Clark, Dabbs, Harlan, Herstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

aerial application of seed and fertilizer, either fixed wing, or helicopter. Both are used in right-of-way seeding. Helicopter would be used for a very specific placement of seed and fertilizer on areas that we want to treat carefully.

To answer your question directly, the timing then is winter, immediately following right-of-way clean up and spring seeding would probably take place in the period of about the twentieth, no earlier than the twentieth of June through to about the first week of July. The northern end of the pipeline route ⁱⁿ particular the coastal plain as generally the snow is rarely off that area before that time. The other restriction there of course ^{being} the calving period of the caribou, which I am advised by our mammals consultant that the twentieth of June gives it at least a full week leeway past the last date of calving so as to avoid any disturbance to that.

Further south, of course, seeding could and would start sooner, early to mid-June. Plots established at Sans Sault were on the nineteenth and twentieth of June and you saw the results of that.

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning,
Williams

Cross-Exam by Anthony

1
2
3 A subsequent seeding of rig
4 sites in the delta area have taken place anywhere from
5 mid-June to about the 10th of July. Quite often those
6 sites, the latter sites that have been seeded as late
7 as the 10th of July have been rig sites right in the
8 delta which were flooded and simply not accessible in
9 the spring.

10 Q Well, let's deal then with
11 the example which I wanted to bring out and which you
12 have touched on, and that is the situation where your
13 seeding program runs in conflict with caribou calving
14 or any other reason why you can't seed. What do you do
15 in those circumstances?

16 A Well, sir, again it's
17 unfortunate we carry on here in the absence of prepared
18 testimony for Phase 3, which is where we discuss the
19 impact on the living environment, and as this topic
20 is covered at that time, or whereas we've touched on
21 it, I've already explained that to our knowledge there
22 is no conflict between the time of seeding and the
23 calving of caribou.

24 Q So is your advice as a
25 result of other conversations with other environmental
26 consultants that there will be no conflict of time,
27 whether it's bird migration or caribou calving anywhere
28 along the route.

29 MR. MARSHALL: Well, you asked
him about the caribou, Mr. Anthony, and he told you
he had some advice from a consultant on caribou.

Clark, Dabbs, Harlan, Hemstock
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Williams
Cross-Exam by Anthony

MR. ANTHONY: O.K., well I'll

expand the question then in the terms that I have outlined.

Q Are there other areas along the route where you're advised there are these conflicts and your seeding program cannot proceed within the schedule you've outlined?

A This topic has been discussed many times over the years with our other environmental consultants. Of course we've worked closely as a team for five years now, and all our thoughts and plans and recommendations have evolved together as a joint group. To date, there has been no direct conflict at which point seeding could not take place identified to me. We recognize that there will be birds in the vicinity of the right-of-way, that aerial seeding operations have the potential for disturbing birds. However, as it's been repeatedly brought forth in this Inquiry, there are many aspects to view here, and seeding and erosion control are viewed as a very major and very important measure to avoid serious environmental conflicts or impacts and though it's been brought to my attention by our own ecological consultants that there could be conflict, they themselves view the seeding an absolute requirement to mitigate the impact of pipeline construction.

However, in addition to that, seeding operation as identified would be a one, or two passes of an aircraft, and it would be out of the

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Anthony

1 There would be no need to return single or double
2 passes of an aircraft, and no further aerial harassment
3 have not proven to be detrimental or have not shown to
4 be detrimental to any bird populations.
5

6 Q I can appreciate we'll
7 get into these questions of conflict and the questions
8 of impact at a later stage, but do I understand that
9 it is your intention that if in situations where, for
10 some unforeseen reason there was a conflict, to proceed
11 with seeding? Is that a priority technique and approach
12 to be followed in the event of a conflict?

13 A At this time a conflict
14 hasn't been identified. However, the seeding is viewed
15 as a very important mitigative measure and the conflict
16 would have to be one which we have not even yet identified, or seen a situation.
17

18 Q Again I haven't had an
19 opportunity of reviewing your Phase 3 evidence, but
20 have you done any studies on the effect of re-vegetation
21 in using the grass species that you've used, the
22 effect of trampling by caribou, the effect of whether
23 the caribou like the grass and will graze in that
24 area, and these type of influences on your re-vegetation
25 program?

26 A We've had studies, one of
27 which was reported in Volume II of the Biological Report
28 series, when we had an amologist working under the
29 direction of Dr. Banfield at the San Sault test site
30 to attempt to evaluate the effect that seeding would
31 have both on the small mammal population and conversely,

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1 the effect the small mammal populations may have on
2 the success of the seeding. The results are clear and
3 have been presented and have been available for a
4 number of years. Briefly the conclusion there is
5 mammal populations, certainly normal mammal populations
6 if such a figure could be struck, do not present any
7 problem in terms of successful re-vegetation.

8
9 Now we ourselves have not had
10 an organized study per se of the trampling effects
11 that caribou would have on plots. However, that work
12 has been reported on by people such as Dr. Mitchell
13 who has worked at Prudhoe Bay. He has found that
14 caribou do seek out and consume the grasses that were
15 seeded on plots. If you recall the slide I showed
16 of the combination of tundra stripping replacement
17 seeding near the Firth River, my comments there were
18 that I've observed caribou tracks where they have
19 annually crossed through those plots several times,
20 certainly at least once each year since they've been
21 established and the combination of those two techniques
22 certainly / reduces the attractiveness of the right-of-way to
23 caribou.

24 The other observation we
25 have has been in relation to some of the work in the
26 rig seeding program where it's been observed that
27 the nugget Kentucky blue and ~~ergmo~~ timothy and the Arctar-
28 red creeping fescue have been severely cropped by
29 caribou and these plants have not suffered as they
30 have regained their former cover quickly.

31 I think that's a review of the

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topic as we have it today.

Q The re-vegetation
program, both with respect to physical erosion and
thermal erosion cover have taken place in plots that
have not been cut down by caribou dining on them or
trampling over the area. Is that what I understand
the plots that you showed to us in your slide and
the studies you've done?

A Sorry, I'm not clear about
the first part of your question

Q The studies that you
referred to and the slides, those studies did not,
on physical erosion and thermal erosion, did not take
into account the effect of cutting down, of the
eating down of the grass to a low level by animals.

MR. MARSHALL: I don't under-
stand that question either. I'm sorry, Mr. Anthony,
the slides depict the situation as it was.

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1
2 MR. ANTHONY: I just wanted to
3 ensure that the test results that we have been discuss-
4 ing and you used the slide as part of your presentation,
5 the grasses were studied there and the test that you
6 illustrated, the grasses were unaltered by cutting down
7 of the grass, whether by eating or mowing or any other
8 way. Is that accurate? Your test results are grass
9 in the natural state as it grew without any cutting
10 down of the grass.

11 A The slide I showed was one
12 in which caribou had passed through many times and have
13 had ample opportunity themselves to eat the grass. The
14 work in the Mackenzie Valley is well beyond the presence
15 of Bering ground caribou in large herds, and we haven't
16 had an encounter with the woodland caribou, and as
17 they travel in much smaller groups that's not anticipated
18 to be a problem the Mackenzie Valley the
19 latter example I used of the rig seeding has been an
20 evaluation of the performance of those species named
21 following severe cropping by caribou.

22 Q Finally, I'd like to
23 direct one question with respect to the winter seeding
24 procedure you outlined. What techniques do you
25 propose to employ to ensure that the seeds don't wash
26 away with spring runoff?

27 A The physical situation
28 in which the seed and fertilizer might be spread in
29 itself will hold the seed as the backfill material,
30 the berm etc. following reclamation.

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irregular frozen lumps and chunks of soil. That in itself will hold the seed and fertilizer in place, and as I said, there will be a need for dress-up seeding particularly on sloping terrain, but in those cases of course we will be there in any case with other treatment such as a placement of erosion control mats and the hand planting of stem cuttings in those areas of high and perhaps even medium erosion potention there would be a need for additional spring work.

Q You'd expect then that in any event you would require, for example on the North Slope of the Yukon, to have aerial seeding in addition to the winter seeding program that you plan.

A I would expect there will be a need for some. However, the streams and rivers that would be crossed would require a small ground crew, in conjunction with the engineers of course, and their physical drainage erosion control measures being put in place, and at that time either at a helicopter seeding of the immediate area, or if the area is small enough, it's quite feasible to seed some of them by hand with a cyclone spreader.

Q I'd like to look then for a moment, if I may, to the section dealing with ground water springs and we've had through the geo-technical panel discussions about the effect of pondings and icings, and I don't intend to repeat that but perhaps we can get a few of the broader environmental terms sorted out, and Dr. Hemstock, or Mr. Hemstock, would you

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1
2 agree with me as a starting point that the incidence
3 of pondings and icings will increase in those areas
4 of extensive ground water activity and springs?

5 MR. MARSHALL: Excuse me, Mr.
6 Commissioner, I don't meant to interrupt. I understood
7 from Mr. Scott that what counsel were intending to do
8 was to cross-examine with respect to those matters that
9 applied to terrain, and then after they had all finished
10 they would move onto water, and then they would move
11 onto matters of air, and I had rather hoped that if
12 that were possible that Dr. Clark might be able to get
13 away Thursday night. He has a rather important meeting
14 on Friday, and I was just wondering whether or not
15 counsel are able to follow that sort of procedure.

16 MR. SCOTT: As horrible as it
17 seems, I think that was our intention and we should
18 perhaps stick to it as long as we can. However, this
19 question is clearly a terrain question.

20 MR. ANTHONY: Mr. Commissioner,

21 --

22 MR. SCOTT: He's talking about
23 ground water.

24 MR. ANTHONY: Mr. Commissioner,
25 I agree with that and I excluded all the questions that
26 I thought related to water, in particular to icings
27 and material dealing with the water regime. I assumed
28 that since Dr. Clark led most of the evidence with
29 respect to ground water problems, icings and pondings,
30 as a result of the chilled pipeline coming in contact

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1 with ground water that he would want to be here for
2 those questions, and therefore I propose to ask them.
3 But I am in your hands, and the hands of Mr. Marshall
4 in that regard.
5

6 MR. MARSHALL: That's fine, sir,
7 as long as they would try. If they could, I would
8 appreciate it if Dr. Clark could be accommodated on
9 Thursday evening.

10 MR. ANTHONY: I see the
11 microphone has been passed to Dr. Harlan. Do you wish
12 to answer that question?

13 WITNESS HARLAN: Would you
14 repeat the question?

15 MR. ANTHONY: I've lost my
16 train of thought.

17 Q I started off, I think,
18 hoping to get agreement as a basic starting position
19 in areas of extensive groundwater activity, such as
20 areas of ground springs increase the likelihood of
21 ponding, icings, and these sorts of problems that
22 Dr. Clark has discussed earlier.

23 A Yes, in the sense that
24 the occurrence of icing is related to ground water
25 discharge. Q: And on page 29 and 30 you've outlined areas
26 which you say have significant ground water activity.
27 Now the first area on page 29, if I'm accurate, in fact
28 covers almost the entire North Slope of the Yukon from
29 the border to Milepost 290, is that correct?

30 A That is correct, yes.

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Q And the second area of these potential problems of significant ground water activity covers about 300 miles of the Mackenzie Valley line itself.

A Yes, along the flanks of the Franklin Mountains.

Q We're involved, then, with at least two very large areas of significant ground water activity.

A Yes.

Q And I understand you are conducting a study which you outline on page 31, to identify further areas of extensive ground water activity. Is that -- when is that study expected to be completed?

A There's a misunderstanding. The study mentioned on page 31 is to better define the source of some of these springs in the known areas, or to identify additional areas.

Q I see, so your study is then restricted to those broad areas that you've outlined as already identified?

A Yes. The program that we have proposed, is proposed and to this point has been accepted by CAGSL, will be in March or April of this coming year.

Q Would you tell us what studies you have done to determine that there are no other areas beyond the two that you've identified?

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A Extensive reconnaissance
of the line. These areas are very evident from the
air.

Q Sorry, I couldn't hear
the last part of your answer.

A These areas are very
evident from the air.

Q You are satisfied and
have so advised Arctic Gas that there are no areas
beyond those two broad corridors worthy of further
study to determine ground water activity?

A On the pipeline, route
Yes.

Q Now, in areas of heavy
ground water activity, if possible would it be a
recommendation that they be avoided and the pipeline
route be re-routed around them?

A Only if they are potential
problem areas.

Q On an area of heavy
ground water activity would that be a type of
potential problem that you would suggest, or is it
only a problem if your remedial measures don't work?

WITNESS CLARK: I think the
point that Dr. Harlan presented with his slides here
was that these icings, both on rivers and land, occur
naturally. If we found that we were going to induce
a new icing in an area where they occur naturally, and
that icing wouldn't affect the pipe, the right-of-way,

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1 or present any environmental hazard, we wouldn't do
2 anything about it. If there was an area where the
3 pipeline could be affected, or we could cause an
4 environmental problem, we would -- our next move would
5 be to look at a mitigative method -- measure.
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We did not have confidence
that the mitigated measure would work, then we would
re-route.

Q What did you mean and
perhaps you could define the terms a little more as
"an environmental hazard" beyond the sort of hazard
that would affect the integrity of the pipeline?

A Well, if an icing
could produce a slope stability problem that would
not necessarily affect the pipeline but might affect
the river by blockage for example, but I would view
that as an environmental hazard.

Q Since you have run
into these problems of ground water icings over such
large portions of the route you can expect, can you
not, that you will have to put your line over at
least some ground water springs.

A We have not run into any
problems of ground ^{water} icings. We have run into the
phenomena of ground water icing. It is a natural
feature of the landscape there during the winter that
icings occur.

Q Have you attempted or do
you recommend that the route be re-routed to avoid
areas of natural icing?

A No, we do not.

WITNESS HARLAN: Possibly I
could make a comment on that. While it is true that in
general that is not so, we have, in fact, made

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Cross-Exam by Anthony

1
2 recommendations on the basis of our fishery studies
3 that in particular instances the route be changed to
4 avoid a spring or an aufeis area, but I think this
5 should come in the next phase of this particular
6 panel.

7 Q I will assist my friend,
8 Mr. Marshall by proceeding questions of ground water
9 icings and terrain as compared to river icings and
10 proceed with those questions at a later date.

11 You have identified icings,
12 as a potential environmental consequence of a chilled
13 pipeline going through areas of ground water activity.
14 Could you outline what are other potential environmen-
15 tal consequences of having a chilled pipeline coming
16 in contact with springs--ground water springs?

17 WITNESS CLARK: Well, Dr.
18 Harlan showed you a slide of a open water area along
19 the Arctic coast which is the site of a large body of
20 over-wintering Arctic char. Now, if our pipeline were
21 to deplete the source of the water to that spring, that
22 would be unacceptable environmentally.

23 Q Would you agree with me
24 that in chilled pipelines to an area such as we have
25 been describing could result in the liquifaction of
26 the soil in that area?

27 A Absolutely not.

28 Q And is this because of
29 remedial measures that you can take?

30 A Yes, I think you are

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1
2 confused with terms. Liquifaction is when soil loses
3 essentially all its strengths and behaves as a viscous
4 liquid. We are freezing the soil off. We cannot
5 postulate freezing off the spring and having liquifaction
6 at the same time. They are incompatible.

7 Q I understand that one of
8 the dangers outlined in the Smytten Report suggests that
9 the liquifaction may result the following summer as a
10 result of ponding outside of the influence of the
11 frost flow.

12 A Liquifaction of the back-
13 fill in a seismicly-active zone could occur if the back-
14 fill were completely thawed, saturated, sand or silt and
15 if it were--liquifaction, if it were to occur on a flat
16 area it ^{is of} no way a consequence. If it were to occur on
17 a slope it would be of consequence. That is why in the
18 area which has a potential for liquifaction we use
19 granular material which does not liquify on slopes.

20 Q Okay. What about the
21 possibility of creating ice lenses?

22 A Ice lenses?

23 Q Yes. Is that a potential
24 environmental result?

25 A That has been the subject
26 of our extensive discussions on frost heave. That is
27 ice lenses we are talking about.

28 Q I am merely trying to get
29 an agreement as to the potential consequences that you
30 see without necessarily getting into detailed disc

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1 of it. Now, you need not repeat the detailed geo-
 2 technical evidence where we discussed the problems
 3 of the water, the contact with the pipe and the
 4 consequent icings and so on. But do I understand your
 5 evidence in dealing with these problems to be that
 6 the remedial measures are basically the insulated pipe
 7 through the frost flow and the use of mound breaks to
 8 re-route surface drainage or subsurface drainage that
 9 has come to the surface?

10 A We are talking about
 11 ice lensing now?

12 Q Well, no, deal with the
 13 general problems associated with ground water
 14 activity, in particular spring activity.

15 A Yes. First of all, if
 16 there is extensive ground water that means very
 17 permeable soil means a non-frost susceptible soil so
 18 we would not have to use our surcharge method to
 19 inhibit frost heavals. That is only used where there
 20 is frost susceptible soil. If we were required to
 21 maintain flow around the pipe, we could use either an
 22 insulated pipe where there is sufficient heat coming
 23 into the area and conduction keeps the frost flow
 24 down to a very small size or else we would carry the
 25 water through the zone that could be influenced by the
 26 cold pipe with an insulated culvert. That particular
 27 technique also requires a fairly substantial flow to
 28 be required.

29 Q Dr. Harlan, I am going to
 30

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would agree with me, would you that the maintenance of natural drainage patterns should be an environmental objective in the planning of this line?

WITNESS HARLAN: Yes, I would agree with that.

Q And therefore, the techniques of the geo-technical panel have outlined that the pipe through the frost bulb for example, is very important remedial technique from your point of view?

A Are we talking about surface drainage or subsurface drainage?

Q We will deal ^{perhaps} with the subsurface drainage at this time.

A I think there is some confusion here in that there is natural dispersion within the subsurface drainage system. To maintain the micro-drainage is not in my opinion necessary. To maintain surface drainage, the general drainage patterns, is more important. So I think there will be situations where it may be advantageous to maintain the natural subsurface drainage patterns where others it may not.

Q Excuse me. Then perhaps let's turn to the area that we agree is of major concern and that is the question of surface drainage. And I would like to look again at this question of the mound technique of the utilizing the mound break. And rather than dealing with it in general because I think

Clark, Dabbs, Harlan, Hemstock
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Q have discussed it in the geo-technical panel at

the meeting. I would like to see the map of the area
 which is shown on the map of the area which is shown on the map of the area
 which is shown on the map of the area which is shown on the map of the area
 which is shown on the map of the area which is shown on the map of the area

Commissioner perhaps to assist you and other counsel,
 I would refer to the alignment sheet, alignment sheet
 1B-0200-1011, which I--

THE COMMISSIONER: That one.

Q Yes. Which I have opened
 behind you. The end is open also on the exhibit desk
 there, which I believe demonstrates the north of Fort
 Good Hope what is meant by horse-tail drainage patterns.

Now, I just use that as
 an example of where on one alignment sheet there is
 an indication of some horse-tail drainage and I
 believe this drainage pattern repeats itself a
 number of times at a number of locations throughout
 the pipeline route. And I think it can be identified.
 Am I right, Dr. Harlan? On that map is the roughly
 parallel dark lines on the alignment sheet running
 across the pipeline route. Are we all together on
 that point?

A We are all together.

Q Could you tell me how
 you propose in that situation for example to ensure
 natural drainage?

A Okay. Mound breaks would

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be provided at the natural drainage depressions.

Q Using that as an example
how often and how regular would you require mound
breaks?

WITNESS CLARK: There is a
classification system given on the drainage and erosion
control measures and that is further elaborated on in
the exhibits and I do believe that does give an
average spacing of mound breaks.

Q Could you give me an
indication of what you are talking about as far as
spacings in an area such as we have been describing?

WITNESS HARLAN: The minimum
spacing indicated on the alignment sheet should be
200 feet.

Q Now, would you agree that
the concentration of water into larger streams in
an area such as this would pose the greatest potential
environmental hazard?

A I am not sure I follow
the question.

Q Well, you obviously will
not be able to construct a mound break to maintain a
natural drainage in that point at each and every drain-
age runnel, I believe it is called along the route.
And I take it from what you said and what Dr. Clark
had said in earlier evidence therefore that the water
at each of these runnels would come to the surface and
would run to the nearest mound break and then across
the pipeline at that location. Is that, in fact what you intend?

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2 for that distance would not cause any erosion or
3 other problem?

4 A No, we don't believe it
5 would. The up-slope side of the berm would require
6 protection along the lines that we've shown in the
7 Drainage & Erosion Control Report.

8 Q Then I believe that, Mr.
9 Hemstock, in your evidence earlier you say that in
10 determining environmental impact you've relied on
11 Environmental Social Committee Reports in part, and
12 in one of them, Report No. 7337, by Dr. Hughes and
13 Mr. van Everdingen, they come to a slightly different
14 conclusion. I'd like you to perhaps comment on your
15 conclusion.

16 In examining this horsetail
17 drainage, they state at page 13 of that report, that,

18 "Drainage of sloping till plain is typically
19 by seepage and sub-parallel shallow vegetated
20 runnels ,"

21 And this is what we've been talking about.

"Concentration of water from the runnels into
larger streams by pipelines routed across this
drainage constitutes the main environmental
hazard of till plains."

You wouldn't agree with that?

WITNESS HEMSTOCK:
No, I certainly would

agree, If all the water were concentrated into the
new channel, a new channel would re-establish under
that particular flow pattern.

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Q But the structuring that
have
you anticipated with the berm breaks approximately 200
feet apart would not cause this type of channeling that
they're referring to?

A Yes, and that 200 feet
is an average there. The actual location would be
determined in the field where it occurs.

WITNESS HARLAN: May I
add a point here? We're dealing with terrain type
R.K.M., which is not a highly permeable material.
We're also dealing with fairly gentle slopes so the
volume or quantities of ground water flow involved
are in fact quite small.

WITNESS CLARK: That slope is
less than 3%, as shown in the alignment sheet in that
classification system.

WITNESS HARLAN: So there is --
we don't have significant quantities of water that
we are dealing with?

Q So you're satisfied that
in conditions of horsetail drainage, and I don't
want to necessarily restrict ^{you} to that particular loca-
tion, so therefore you may expand your answer to
include greater slopes of greater degree. The
remedial measures you propose, you feel, can adequately
deal with that problem of channelling along the
pipeline?

A Yes, very definitely.

Q Have you conducted any

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1 studies on the erosion and on the slopes of 3 degrees
2 and the effect of -- in this drainage pattern in
particular.

A Not in this
pattern, no.

WITNESS CLARK: We've made
use of studies by other than this.

Q You made use of studies
by other than this?

A Strang, for instance,
who was specifically looking at erosion and drain
sensitivity related to slopes and so on.

Q We may be getting back
to it. Thank you. In addition to the mitigative
measures that you've outlined in your evidence, I'd
like to suggest, Mr. Hemstock, that perhaps there
are other mitigative measures available to you, just
to put on the record and to ensure that you as an
environmental consultant agree that these measures
should be and could be implemented from time to time.
I would think you would agree as a starting point that
in addition to those five you mentioned, that the
location of facilities such as compressor stations
and fuel depots and so on is another mitigative measure
to prevent detrimental environmental impact.

WITNESS HEMSTOCK: Yes.

Q And have you been involved
in the question of location and re-location of compress-
or stations?

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A Yes.

Q And are there currently
any compressor station locations that are under study
for environmental reasons?

A Yes.

Q Could you tell us which
ones you are presently examining?

A I can't recall the
station numbers, but there are two stations in the
-- along the coastal plain that are located in or near
snow goose staging areas, or areas that have been used
in the past for snow goose staging; and we will be
taking a look at whether they could or should be moved.
This year, though, the evidence was that the snow geese
didn't use that area at all, so again we have to take
another look at the importance of it.

Q Were you looking at the
re-location of any compressor stations for terrain
reasons?

A Not that I am aware of,
no.

Q The Pipeline Application
Assessment Group in their report at page 217, and I
merely give you the reference, but they suggest that
the re-location of the compressor station at Thunder
River -- and there were others at times but I'll deal
with that one specifically. As a result of their
request, was there any environmental re-evaluation
done of that compressor station location?

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2 A I can't recall that
3 there was, but perhaps Mr. Williams is aware of
4 something there. The compressor station at Thunder
5 River?

6 MR. MARSHALL: I'm sorry,
7 Mr. Anthony, are you talking about, because of terrain
8 considerations, or environmental considerations, or
9 are you not being that specific?

10 MR. ANTHONY: I thought I
11 restricted it to terrain considerations. The one
12 I'm referring to is on page 217,

13 "Pipeline Impact and Valleys,"
14 and on the top paragraph there, in dealing with this
15 Thunder River compressor station, the Pipeline
16 Application Assessment Group suggests that the
17 re-location of the compressor site to a better drained
18 area a mile or so from the valley wall. I was wondering
19 whether that suggestion had been taken up, or whether
20 it was being considered.

21 WITNESS CLARK: It was looked
22 at. I forget now exactly what decision was reached.
23 That particular station, I recall, is not at the
24 hydraulically balanced point, because that particular
25 point falls right into the middle of the river. Two
26 sites were looked at, one upstream and one downstream.

27 Q Well, I believe that
28 the site that presently is chosen is located as
29 far as the confluent drainage from three small lakes.
30 Now, have you studied the effects of this, and is

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1 any reports or studies, or can your counsel advise
2 us of where this matter stands?

3 A As I say, I don't
4 recall the details, but I know that we have moved
5 stations for similar problems to improve drainage or
6 foundation conditions.

7 WITNESS WILLIAMS: My recollec-
8 tion is that there was a double-barrelled station
9 in that area where I think they suggested moving the
10 pipeline route about two or three miles farther east.
11 Is that not correct, Mr. Anthony? I haven't read it
12 for a long time but it seems to me at Thunder River
13 they suggested going upstream about three miles where
14 the proposed Mackenzie Highway location was, so the
15 location of the station would then, if there was a
16 route change, the station location would change. We
17 examined it but have not decided to recommend any
18 route location change in that area.
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Q I gather from what Mr.

Hemstock said, there is no pressure from environmental advisors for the re-location of that compressor station either.

WITNESS WILLIAMS: No, I see that in the -- the only reference I would think here/has to do with two concerns in our area: (1) is the crossing of the river itself of the pipeline, and Dr. McCart would be looking at that; and (2) the other there is apparently a concern that the compressor station might impact on the wilderness scenery along the valley. I believe there is a suggestion there it might be moved on that basis.

I'm not aware that we have done any site-specific studies of this particular station.

Q Are you intending to re-evaluate the site locations at the time of final design, or is this a dead issue as far as you are concerned?

A No, no. All of these compressor stations, there will be site specific work done just as there will be for borrow sites.

Q Well --

A Generally, though, it would be a matter of the details and a fairly small move involved.

Q -- you touched in answer to the last question the next point I would like to suggest as a mitigating measure, and that is mitigating

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1
2 environmental impact and the role of aesthetics with-
3 out necessarily getting into the details of what is
4 aesthetics and how you should protect them, would you
5 agree with me that the principle of restoration and
6 the re-contouring, of cleanup and control of herbicides
7 and other aspects of aesthetics should play a role
8 in the location of the pipeline and the restoration
9 or re-vegetation program?

10 A Yes.

11 Q And that for purely
12 aesthetic reasons then, you would recommend that there
13 be certain programs of restoration and re-vegetation.

14 A That's right.

15 Q Above and beyond problems
16 of erosion control and so on, purely to maintain an
17 aesthetically pleasing environment?

18 A That's right, and with
19 other factors being equal, the location in some
20 cases can be modified in order to satisfy aesthetic
21 reasons.

22 Q Another mitigative
23 measure could very well be the question of contingency
24 planning and planning for problems unexpected or
25 accidental problems. Would you agree this is a tech-
26 nique of environmental protection?

27 A It's a technique of
28 environmental protection and it's also required, of
29 course, for the satisfactory operation of the pipeline.
30

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Q And are you presently
involved in the preparation of a contingency program?

A We have done some work
on it, yes, and I've been in touch with producing
companies who have contingency plans in force now.

Q Could you tell me what
work is being done on the area of contingency programs,
what subjects you're studying and what type of plans
are formulated?

A With regard to what
kind of impact?

Q Well, we'll deal with
perhaps a few particular ones, the use of explosives,
fire and fire prevention, control of toxic spills.

A Well, the use of explosives,
again there are strict regulations and so on
which are required in the use of explosives. We would
expect them to be primarily used in the construction
process, and from an environmental point of view, there
is, in my opinion, very little concern because there
is virtually no wildlife in the area.

In the event of toxic spills,
which would include oil or fuel spills, the contingency
plan which we will have will be tied in very closely
with those plans which are already in force by the
producers and they include the location of such things
as absorbent materials, vehicles, dyking material and
so on, and oil booms, clean-up devices at strategic
locations along the route. These are the kind of things

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which we will be involved with.

Q Well, I'll deal with the toxic question in a little more detail in just a moment, but do I understand that you are recommending a comprehensive contingency plan with respect to fires and explosives, as two examples, or are you relying on government or other regulations to provide you with terms and conditions of such a contingency plan?

A We will have our own regulations with regard to explosives.

With regard to fires, we will -- well, I think we have already stated in the application, the criteria there. We would expect that the pipeline itself would have very little impact on the number of fires again because construction is in the wintertime.

The other aspect is, of course, that surveillance of the pipeline on its regular basis will be a method of much quicker detection of fires along the right-of-way, and we would think that this would in fact be an improvement on the fire situation.

So we will have those kind of things particularly in the operations criteria.

Q Dealing then with the fuel and toxic substances, are you as Arctic Gas, preparing a comprehensive contingency plan for dealing with accidental spills, or are you relying on someone else to do this?

A We will be adding to what

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Cross-Exam by Anthony

1
2 is already available in industry for that kind of
3 planning, and we will be involved with a group that is
4 already formed, and it's called DEPU, Delta Environmen-
5 tal Protection Unit, and they have already several
6 hundreds of thousands of dollars of equipment on-site
7 at Norman Wells and in the delta. We will be co-
8 operating with that program and adding to it.

9 Q Well, have you formulated
10 yourself any terrain protection suggestions, or criteria
11 that you will demand?

12 A We haven't anything
13 different so far from what is already practice with
14 this group. The principles are that in winter if the
15 spill is in winter, that you dyke it off as quickly as
16 you can, that you clean up by pumping and if it's
17 fuel oil, burning the waste product, that you do not
18 go on with large vehicles and do a land reclamation
19 like you do in the south, that you locate the fuel
20 storage and so on at reasonable distance from water
21 courses and water bodies, that you provide dyking
22 around the storage in order that breakage of tanks
23 and so on is prevented from causing spills onto the
24 land or water surfaces.

25 Those general kind of
26 things are already standard practice and we would
27 simply pursue that, or follow that. I really don't
28 think there's anything very different about our
29 operation.

30 Q Well, in order that we

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Cross-Exam by Anthony

1 may perhaps comment and consider the spill, I wonder
2
3 if your counsel could provide us with copies of the
4 -- this organization's recommendations and environment-
5 al protection criteria?

6 MR. MARSHALL: Well, why don't
7 you ask the witness about them, and whether they exist,
8 and so on?

9 MR. ANTHONY: I assumed that
10 they existed because he was going to rely on them and
11 not go beyond that.

12 Q Now, are there in fact
13 environmental protection measures that exist through
14 this organization?

15 A Surely.

16 Q And could we then obtain
17 copies of these regulations so we may study them in
18 detail?

19 A Yes, I'm not sure how
20 much of this is written down and how much of it is
21 simply in the field in practice; but whatever there
22 is we can provide for you.

23 MR. ANTHONY:

24 Well, perhaps if counsel
25 then can provide us with that, we can proceed with
26 more specific comments or questions as to the size
27 of the dykes and the types of dykes, and whether they
28 will work in the Arctic terrain. After we've had
29 an opportunity to examine that material I'm sure we
30 will have occasion to proceed with those questions
31 at that time.

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MR. MARSHALL: Well, if you have any specific questions, why don't you try to see if Mr. Hemstock can deal with them? He has some familiarity with the techniques that are employed, and perhaps we can dispose of it and not have to return to it at a later date?

MR. ANTHONY: I'm prepared to deal with a few perhaps general ones until we've had a chance to examine the basis of your recommendations.

Q Have you made any recommendations then to Arctic Gas with respect to method and places of re-fuelling?

WITNESS HEMSTOCK: No.

Q Have you made any recommendations, for example, as to whether or not fuelling should take place on ice during the wintertime?

A Well, those regulations are part of the land use regulations. Now we would certainly follow those regulations.

Q Have you made any recommendations as to the storage of toxic chemicals and the use of containment dykes?

A Again those are -- yes, we have mentioned those in the application. The basics are that the fuel and toxic chemicals will be stored in tankage protected by dykes with a 1 1/4 volume safety factor.

Q I believe most of the other questions relate to the aquatic phase, so I will

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1 defer those questions at this time, except to bring in
Mr. Koskimaki, if I may, for a moment. He's been
sitting quietly there for the morning, and deal with
the question of lubricants and other toxic chemicals.

Can you tell me, you
recall last time when you were here we asked the
3 question of the use of high temperature lubricant
such as Amolax S-140, and other lubricants of that
nature, and can you tell me whether your plans have
1 firmed up any further, and whether in fact you intend
to use these types of lubricants at the compressor
station?

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Williams,
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A No there has not been any definite change in any plan. The turbine machinery specification which we have issued to manufacturers doesn't specifically exclude the use of these type of lubricants. I think it is the general feeling that they would not be used in the compressor but I think it is left a little bit open on the turbine portion of it.

Q Therefore the possibility of this highly toxic lubricant still remains.

A Yes, Sir.

Q When do you expect to be in a position to know whether or not you will be using and therefore storing these materials?

A Probably later on this spring when the specific type of turbine is selected, the specific manufacturer, then we would know for sure which lubricant would be used.

Q Since there is a possibility of this lubricant being used, what protection measures do you recommend to insure it doesn't get into the environment?

A The... I think the general intention is to transport the lubricant back out of the Arctic after it has been used so it won't be disposed of in the Arctic. If it is of this toxic type

It wouldn't get into the environment from something like a line break because it would not be used in the compressor I don't think.

Q You would recommend then that that technique be utilized. The technique of shipping off of these toxic lubricants back south?

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A I believe that was what the group stated that they were going to do.

MR. HEMSTOCK: I might add from here that the enviromental standpoint we are doing a survey of our sponsors and getting a recommendation with regard to the use of these lubricants and the evidence that we have so far and we have not quite completed this is that they can be replaced and they are being replaced now in most operations with non-toxic materials and if that conclusion is finally reached as it appears to be shaping up now then we would be recommending that the highly toxic lubricants not be used at all.

Q Well in response to Mr. Koskimaki's earlier attendance counsel filed a list of chemicals expected to be used at the various sights and that is still the current position and pending the result of this further study and report that you...

A That's right. That is still a current position but I just wanted to point out that we are taking a close look at that.

Q I would like to look then briefly at the question of sewage disposal in the more general term. Now, I believe that the position, and we can agree that there will be no direct discharge of sewage into water. This is the basic premise that we start from. Am I with you on that score?

A I think we have made Mr. Williams a sanitary engineer too.

MR. WILLIAMS:

A No direct discharge of raw

near the, near the shore, back
from the shore of Great Slave Lake.

Q But can you, I am just
wondering whether it is the intention or if you have
made any recommendations as to the type of terrain that
should be used or whether you are satisfied that any wet
organic terrain is suitable for waste disposal.

A No what we, what is not
said in the written testimony here and should have been.
is that the type of treatment, waste water treatment
used at any location will be dependent on a site specific
study and we haven't done those studies yet so we can't
say what type of treatment would use, would be used at
any particular location but we can certainly talk about
it in generalities.

Q In determining the type of
of course
treatment of course it depends on the type of terrain
that is around the particular location.

A That would be one of them.
yes.

Q And more sensitive terrain
units around the site would require more extensive treat-
ment within the site?

A That is a possibility. For
instance I wouldn't see excavating a lagoon in sensitive
perma frost or in high ice content perma frost.

Q Are you presently conducting
any studies of the suitability of various types of
terrain for waste disposal?

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Cross - Exam by Anthony

A No. No we haven't done any
site specific work yet.

Q Would you recommend that
such a study be done before the waste treatment has
evolved?

A Yes Sir. That is just what
I said. It will be done for each type.

Q This will be a matter of
final design?

A Yes Sir.

Q You also state in your
evidence that there will be discharge into heavy bush.
Perhaps you could define what you mean by that and what
terrain characteristics you are relying on to ensure
there is no enviromental degradation?

A This again is affluent that
has been treated, has had secondary treatment. It would
be preferably in a fairly flat area that would contain
it for awhile and not go directly into streams.

MR. MARSHALL: Excuse me, Mr.
Commissioner. It might be some assistance to Mr.
Anthony and the other counsel in this area if I point out
that in this area of waste disposal both Arctic Gas and
Foot Hills have utilized the services of Associated
Engineering Services and Mr. Norm Lawrence of that
organization is going to be presented by Foot Hills in
one of their panels and that is the firm that has done
studies for both Foot Hills and Arctic Gas and I think
he, in the prepared evidence that Foot Hills is filing.

1
2 Mr. Lawrence indicates that essentially the same **app**-
3 roach is being taken by both of the companies. So if
4 there is some fairly detailed questions as to method-
5 ology and so on perhaps Mr. Lawrence is best equipped to
6 handle those.

7 THE CHAIRMAN: Well I think we
8 will adjourn for coffee.

9 (PROCEEDINGS WILL ADJOURN FOR A FEW MINUTES)

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(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR. ANTHONY: Mr. Commissioner, I would like to turn to a few questions with respect to the abandonment and I am dealing with in the terms-- both in the long term abandonment after the economic life of the pipeline and intermittent abandonment as you finish construction in particular areas. I think, Mr. Hemstock, you have covered some of these points with respect to--in your comments--with respect to aesthetics and restoration and re-vegetation and I will not proceed on those but I would like to ask you whether you made any recommendations with respect to the temporary roads as a particular example following abandonment of a particular spread or particular area.

WITNESS HEMSTOCK: The plan would be that the temporary roads would be restored if there was no plan or no requirement for them in the following years of the pipeline.

Q The roads that are shown as temporary roads to borrow sites for example would they be then taken out or the area stabilized?

A I think most of those roads are snow roads and they of course would be restored if there was any damage done to them. I have to check with Mr. Williams. I do not think there are any which would be required for, or would be temporary roads that would not be required or left throughout the life of the pipeline.

Q Are there any--

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WITNESS WILLIAMS: There might be a few that are used in two successive years, but I do not think there is any long term requirement for the temporary roads unless you get into a looping program or something like that.

Q What about the stock pile sites and other temporary sites that are created during construction periods? What is the intention with respect to these?

WITNESS HEMSTOCK: Those would have to be evaluated on a site specific basis. The sites might be required for the operation of the pipeline. There might also be other uses to which they could be put. I think each one would have to be checked independently. If there appeared to be no further requirement by ourselves or by anyone else in the area then the staging site or the site would be restored.

Q You mentioned possible other uses of the site. What were you thinking of in that context?

A It could be one of the local village or town or it could also be another development such as the oil pipeline might require, might make use of--sites which had been installed for the gas pipeline.

Q Dealing generally with the question of long-term abandonment I gather from the evidence that you have led here and from the view

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Cross-Exam by Anthony

of other materials that the expectation is that the pipe is to be left in the ground following the end of its economic life. Is that your understanding?

A That would be my expectation, but certainly I believe that it is much too early to predict what you would want to do with the pipeline several decades from now and at that time it might well be that there would be a need or a desire to reclaim the steel in the pipe. And in that case, the decision would be made at that time.

Q Have you currently under-
way or have you done any environmental studies of the impact of abandonment?

A None in specifically at abandonment. Obviously though the observation of long-term disturbances in the Arctic which have been alluded to are good indications of any condition of the right-of-way at abandonment.

Q But you are utilizing a unique technique in that area in the extent of a chilled buried pipeline in very unique terrain and we have had from the geo-technical panel and even yesterday discussions of the sorts of things that take place following abandonment and you have made some comments in your statement here. Now, are these comments on ^{the} basis of any studies, or reports, or how did you come to the conclusion that the impact of abandonment would be insignificant.

A Simply on the basis of

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observations of long-term disturbances I do not see anything particularly different about this. It has been mentioned of course that there would be specific areas where there might be frost heave but it was also pointed out that the frost would deplete very slowly and that the area which was stabilized would, in my opinion, remain stable.

Q But don't you have to do a study to determine or somehow evaluate these conclusions?

A No, I do not think so.

Q You are prepared to make come to your conclusions about the abandonment and the impacts of abandonment on the basis of your general observations?

A Yes.

Q Have you made any recommendations about the compressor stations and whether they should be removed or how they should be dealt with following the economic life?

A We have indicated that the structures would be removed if they were not required for further use. And again, the pad on which the compressor station was built would be either restored or if there was some other purpose it would probably be left in its, left as it was.

Q Have you attempted in any way to evaluate the cost of rehabilitation of the terrain following abandonment?

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A No.

Q I would assume therefore
that the cost of abandonment was not considered at this
time as the cost of the project?

A No. Not of any great
concern to the project at this time.

Q There is also no evidence
led with respect to the question of looping. Are
you in a position to make any recommendations about
the time that should elapse between the laying of the
first pipeline and the looping in a particular area?

A I think from an
environmental standpoint our, one of the points that
we would make with regard to looping would be that the
we would prefer to see the re-establishment of
pretty good vegetation cover on the right-of-way
before this second activity took place. And that is
probably the only area of concern.

Q Have you done any studies
on the impact of the second attendance and the sort
of conditions that you describe?

A No. I don't think we have
done any of those directed to those specific points.
Again though there is a good deal of activity in the
Arctic and simply by observation you can see areas
which have been utilized for certainly for more than
one year. We have not done anything specific on this
point though.

Q Do you have any current

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studies under way to determine the environmental impact
of a looping program?

A I don't think that there
is anything directed specifically at looping. There
is of course the very extensive program on monitoring.
This is the impact of the pipeline and from that one
would expect to be able to make judgments on the impact
of a second operation, but that is an ongoing thing and
it will continue through the construction and into
the operation of the proposed pipeline.

Q All your environmental
though
conclusions are based on your assessment of the impact
of a single pipeline in the Mackenzie Valley though?

A Yes, I think that is
fair.

Q And would you recommend
therefore that there be a further and complete
environmental review before any looping program was
undertaken and approved?

A Yes. Before any looping
program was undertaken there would be a further study.

Q Mr. Hemstock, are you
presently in a position to assess the suitability of
this line of the Arctic Gas proposal with respect to
the nearby routing of a second pipeline, either a second
gas pipeline or an oil pipeline?

A From the studies which we
are aware of the preliminary studies of the possible
oil line, we would see no particular difficulty with

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1
2 regard to the construction of another line, an oil
3 pipeline. Again, of course, that would have quite
4 different engineering problems and those will be assessed
5 I am sure by the people who are working on that system.

6 Q Are you in a position
7 though to advise this inquiry of the studies that
8 you have done or any conclusions you have come to about
9 the cumulative or combined effect of an oil pipeline
10 and a gas pipeline on the Mackenzie Valley?

11 A No, I don't think that
12 there are any of our studies that are directed to the
13 cumulative effect. The studies which we have done
14 include things like disturbance and of course there
15 is no time limit indicated there. We would expect
16 that the disturbance studies which we have completed
17 would be useful and be constructive to other pipe-
18 line construction. Dr. Banfield has alluded to the
19 possibility of synergistic effects between the two.
20 We have not delved further into those aspects.

21 Q Have you both been
22 instructed by your clients to do a study of the
23 combined effect of the two pipelines?

24 A No.
25
26
27
28
29
30

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WITNESS HEMSTOCK: No.

Q And you've referred to preliminary studies that form the basis of whatever comments you've been able to make to this point. I wonder, are those reports available and maybe could be provided to this Inquiry?

A Well, the Mackenzie Valley Report is available. I presume the Inquiry probably has it.

Q Are there any others?

A It's a public report.

Q Beyond that Mackenzie Valley Oil Pipeline Study, which I believe may have been made an exhibit here, are there any other studies that you are aware of that

A No.

Q Well, I'm coming to the conclusion that the Mackenzie Valley is the appropriate route for a pipeline. Don't you have to know the cumulative and the combined effect before you can properly assess the environmental impact of your pipeline proposal?

A By doing those studies of our line, we have looked at the installations which are already there, and looked at the impacts which we expect to occur as a result of the construction of the gas pipeline, and we see the construction of the gas line as a relatively small part of the total impact on the Mackenzie Valley corridor. We don't see

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then that there is any problem in providing for that facility in the corridor which is already there. If other installations are added, then presumably they will have the same kind of intensive investigation as this Inquiry and the impact of that additional installation, whatever it might be, will be evaluated at that time.

Q Would you agree with me, though, that the result of a study, for example, of an oil pipeline might be very clear ^{it} come to the conclusion that the pipeline should stay outside the valley?

A I wouldn't be prepared to guess what the results might be.

Q But if such -- if you can accept that assumption for the purposes of the further question -

A I might point out that the preliminary study by the Mackenzie Valley Study Group indicated that they, as I recall, found no great difficulty with the proposals to build an oil pipeline down the Mackenzie Valley.

Q If the proposal was to put the oil pipeline outside the valley east of the Franklin Mountains or some other location, would that not change your assessment of the impact of the gas pipeline?

A No.

Q As far as you are concerned, the combined effect or the location of the

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Cross-Exam by Anthony

oil pipeline is irrelevant to any environmental assessment
of the proposal presently before this Inquiry.

MR. MARSHALL: Well, Mr.

Anthony, I don't think that's what he was saying. If
you're asking him a question, fine; perhaps he can
answer it. But if you're stating that as a summation
of what the witness has said, I don't think he said
that.

MR. ANTHONY: Well then,

perhaps he could respond in those terms then.

MR. MARSHALL: Well, I don't under-
stand the question, really.

Q Do you view the location
of the oil pipeline and the combined effect of the
oil and gas pipeline as beyond your terms of reference
in defining environmental impact of the Arctic Gas
proposal?

A No, I think that it's
a matter that we should consider and I indicated that
I didn't think that there was any problem posed by the
construction of an additional facility. I think that
pretty well sums up my concerns.

Q But you come to that
conclusion without conducting a study of the combined
effect of the two lines, and yet you do not recommend
that this study be conducted.

A I don't think that you
need to conduct a study to come to conclusions in
every case. I think that, as I've said, there have

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Cross-Exam by Anthony'
Cross-Exam by Bell

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2 been extensive studies, the impacts have been
3 measured of disturbances, and based on that it is
4 my judgment that you don't need to go any further.
5 I'm not sure that I could even define the terms of
6 criteria for a study, to do this kind of thing. I
7 think that the kind of study that should be done is
8 the kind which we've already done -- observe what has
9 gone on from previous activities, plan your activities
10 so that you will minimize disturbance.

11 MR. ANTHONY: Thank you. I
12 have no further questions.

13
14 CROSS-EXAMINATION BY MR. BELL:

15 Q Mr. Hemstock, you say
16 in ~~the~~ prepared evidence the total amount of lands
17 that will be used for this project is 42.5 square
18 miles, I believe, that includes both permanent and
19 temporary facilities. I think that figure appears
20 -- those figures appear on page 9. Does this figure
21 take into account land that would be required for
22 primary indirect economic activity which would be
23 generated by the pipeline?

24 WITNESS HEMSTOCK: Such as?

25 Q Well, I'm not exactly
26 sure what the applicant means when he says, "primary
27 indirect." I got that phrase from the application. I
28 suppose I could look it up. There is two types of
29 economic activity which are not identified as primary
30 direct. One is primary indirect, and the other is

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Cross-Exam by Bell

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2 secondary, and I would like to know if the land figure
3 that you gave us includes land requirements for those
4 economic activities?

WITNESS WILLIAMS:

5 A The acreages of square
6 miles shown, Mr. Bell, are a summation of the tables
7 that are on the right-hand side of the strip maps.
8 The acreages for various facilities are shown there
9 and this is just a total of those numbers.

10 MR. MARSHALL: If I can assist,
11 Mr. Bell, I believe that the figure, total figure
12 relates to what's being applied for by Arctic Gas.
13 It wouldn't relate to other activities that may arise
14 or take place as a result of the project going ahead.

15 MR. BELL: I see.

16 MR. MARSHALL: It would
17 relate to the land, the use of which is required
18 directly by the project.

19 MR. BELL: So that this would
20 not include primary indirect or secondary economic
21 activity generated by the pipeline?

22 THE COMMISSIONER: Well, I am
23 satisfied that it doesn't. For instance, Mr. Blair
24 said that the principal result from, one of the principal
25 results if you build a pipeline is to enhance oil and
26 gas exploration activity. Anyone who has travelled
27 through this country knows that the seismic/cuts take up
28 a great deal of acreage and that's obviously not
29 included in this figure they're applying for. If some-
30 one built a petro-chemical plant at Fort Simpson, which

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Cross-Exam by Bell

1 I hasten to add on the basis of all the testimony we
2 have heard, seems absolutely out of the question,
3 they are only now getting it in Alberta where they
4 have had an oil and gas industry for a quarter of a
5 century. But if that occurred that would be primary
6 direct or something like that, and they're not applying
7 for that either.

8
9 WITNESS HEMSTOCK: Directly
10 associated with the pipeline acreage.

11 MR. BELL: Q I take it from
12 that it would not include land required for looping
13 a line either.

14 A No, it does not include
15 that.

16 Q So your comments concern-
17 ing the significance of the impact of the withdrawal,
18 if I can call it, of this particular area, relates
19 solely to this project and to the terrain traversed
20 by the pipeline and used by its ancillary facilities.

21 A Yes.

22 Q Miss Minning, you showed
23 us a drawing, I don't know the exhibit number, it's
24 called,

25 "Proposed development of borrow, No. FGH-2."
26 It's a proposed borrow pit in the neighborhood of
27 Fort Good Hope. Is this the site known locally to
28 residents of Fort Good Hope as "Old Baldy"? Do you
29 know that?

30 WITNESS MINNING: I think so.
I think that's probably true.

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bell

Q And is this the preferred
alternate borrow site in that area?

A This is the preferred
borrow site.

Q Can you tell us where
the alternate one is?

A Just a moment, I'll
look.

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bell

A It is quite a large deposit. There is an out-what's known as a outwash plain associated with the esker here and Fort Good Hope too, which appears in the strip map is the preferred site.

Q The alternate is part of the same formation. Is that what you are telling us?

A That is correct.

Q I think I understood you to say yesterday that you had contacted the Department of Indian and Northern Affairs to see if they had any comments on the proposed borrow sites. And they had experienced some delay in getting a reply from them.

A I did not say that we contacted the Indian and Northern Affairs on each borrow site.

Q Could you clarify that please?

A When we apply to use a borrow site, we will contact Indian and Northern Affairs and we will submit a development plan for the site and it will be approved or rejected. In this case it may be rejected.

Q I think I also understood you to say that you would be consulting communities in the neighbourhood of borrow sites?

A That is correct.

Q And that if there were some conflicting use, you would be prepared to go elsewhere?

Clark, Dabbs, Harlan, Herstein
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bell

A That is correct. I might add that this deposit actually extends out of the development zone of Fort Hope. At the other end, it is out of the development zone. Perhaps we would have to go to the end that is not in the development zone.

Q Well, perhaps I could help to expedite the process of consultation here. I am sure that if you contacted people of Fort Good Hope you would get a speedy reply concerning your proposed borrow site because I am informed by the residents there, some residents there anyway, that Old Baldy has long been favoured by the people of Fort Good Hope as a picnic site and recreation area. No doubt because it is a very pleasant location and--

A Apparently there is already a gravel pit there in this deposit.

Q Yes, I understand that also that the people were not entirely pleased by the opening of that existing pit and I would like to put it to you. Surely you would not recommend that Arctic Gas carve up the best picnic site in Fort Good Hope.

A Of course not.

Q Thank you.

THE COMMISSIONER: Well then, now we can turn to the alternate sites which I am sure Mr. Bell is about to suggest.

MR. BELL: No, I have gone as far as I want to go. Thank you. Those are all the questions I have.

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

CROSS-EXAMINATION BY MR. BAYLY:

Q Miss Minning, if we could turn to page 4 of the prepared evidence. You have referred in your evidence under point 3, "Borrow Requirements", the construction of various facilities. And I am wondering whether your estimates of 30 million cubic yards are based on average berm height for the facility. In other words, an average sized berm. Some of your borrow is going to be required for the construction of a berm. Is that correct?

WITNESS MINNING: You mean a
the
berm on / pipeline?

Q That is correct.

A Yes, that is correct.

Q Now, you must have taken into account when you were estimating that you needed 30 million cubic yards that some of that 30 million cubic yards was for the construction of this berm. In order to do that, you must have said the berm will be of the certain size or at least a certain average size. Is that correct?

A That is correct.

Q Right. What is that average size?

WITNESS CLARK: I don't recall exactly but I think that we chose as an average size a three foot high berm and I forget over what length that ^{was} applied, but for example, if you had a six foot high berm, 45 feet wide, I think it works out to about

Clark, Debbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

50,000 yards per mile. I think that the quantity that we indicated was arbitrarily selected for each segment related to the pipeline. Our major requirement is for the facilities, the compressor station and air strip, and they were determined on the basis of an assessment of the relief, the terrain type, the climatological region and we arrived at an average thickness.

Q Now, you have taken then as an arbitrary figure, I assume, half of that because you are anticipating an average berm height of 3 feet rather than 6 feet. Is that correct?

A That is what I recall, Mr. Bayly. I don't remember the details of our input into that component of the estimate.

Q And keeping the slope the same on a berm as it would be on a 6-foot berm, it would probably be approximately half as wide as the 45 feet that you told me would be required for 6-foot berm?

A That is correct.

Q Now, without getting into the merits or otherwise of Dr. Williams' theory as opposed to Dr. Slusarchuk's theory. Assume for the purpose of this question that Dr. Williams is either right or partially right in that you need more surcharge than you have anticipated. What sort of requirements would there be if, as I believe he said, you might require a berm as high as 10 feet?

A I think he used a figure

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

substantially greater than 10 feet.

Q I think he said 20 as
a possibility and I just hesitated to use that because
it seems awfully high.

A Well, I think he threw
in two extra figures: 10, 20, 50 and 100. Taking the
10 feet, it would be about two thirds as much again as
the 50,000 maybe 75,000 yards per mile or something
like that.

Q And is that way we would
calculate in his increments?

A You can just about double
them, yes.

Q You can double them or?

A If you double the height
you can just about double the material.

Q And, that is the proper
way of estimating it.

A Well, it is probably
adequate for your purpose right here.

Q Well, that is what I--

A It depends on the slope
angle, you might change to a different side slope on
a high berm that would require more material.

Q I am assuming if it were
a hundred-foot berm, you would need a bigger right-of-
way?

A Yes.

Q And more grass seed.

1 Clark, Dabbs, Harlan, Hemstock
2 Koskimaki, McCart, Minning
3 Williams
4 Cross-Exam by Bayly

5 THE COMMISSIONER: You might
6 even have to make a dent in Old Baldy.

7 MR. BAYLY: Thank you. I
8 appreciate Mr. Bell's concerns. Miss Minning, have you
9 in your calculations of amount taken into account this
10 sort of contingency that you may have to alter--amounts
11 of borrow required for something like this?

12 WITNESS MINNING: I think so.

13 WITNESS CLARK: We haven't
14 taken it into account specifically but we did add a
15 contingency to the overall amount. And if you used
16 your 10-foot berm at roughly 75,000 yards a mile, if
17 we forced to do a hundred miles of that, that would
18 just about eat up your contingency which is about
19 20%.

20 Q Yes. Now, I gather that
21 certain materials are suitable for air strips and
22 would not necessarily be required ^{the} for construction of
23 a surcharge berm where you are interested in weight
24 rather than in certain other things. Is that fair to
25 say?

26 WITNESS MINNING: That is correct.

27 Q And, so when you are sel-
28 ecting borrow sites, you are looking for not only
29 coarse granular material which is good perhaps for
30 making cement and surfacing roads and air strips but
31 you would be content with material with more organic
32 content or perhaps more ideally, more sand or even

Clark, Dabbs, Harlan, Hemstock
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Cross-Exam by Bayly

larger boulder content.

A That is correct. In fact, in the southern part of the Mackenzie Valley, I think that some of those things will have to be used in great quantities because gravel is not very abundant.

Q Now, you have given us a figure of 30 million cubic yards and that is a borrow requirement including all these various types. Is that correct?

A That is correct.

Q And have you broken that down for your ^{own} purposes into the kinds, or the amounts of the kinds of material you will need for the various purposes which you anticipate?

A That is correct. We have had to submit to DIAND whether, how many cubic yards of class 1, class 2, class 3 material that we want between certain milages along the pipeline route. Yes, we have done that and submitted it to DIAND.

Q And, would it be fair to say that in some areas you have got lots of everything you need-- lots of class 1, 2, etc. and in other areas you either have none or you face long hauls. In other words, you would have to substitute materials or haul the material you want from a long distance?

A That is correct.

Q What sort of thing and I assume that you need certain things with the surcharge berm but what sort of materials are satisfac-

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

tory for the berm? What sort of borrow material?

WITNESS CLARK: Just about
anything except organic material.

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

1
2 Q If there were any organic
3 you would only want that for the top so that Dr. Dabbs
4 could put his grass root onto it.

5 WITNESS CLARK: Yes.

6 Q Would you have a preferred
7 kind of borrow? Would you prefer one with very good
8 drainage of coarse material?

9 A I would think that we
10 would want probably a fine-grained material that could
11 be re-vegetated readily.

12 Q That's in the case where
13 you don't have a dressing, that you stripped off like
14 in a tundra area.

15 A Yes.

16 Q So you would be actively
17 looking for material that was not similar to the type
18 of material you would use on a road or for the compres-
19 sor station pad.

20 A That's correct, but I
21 think that in some areas we'll be using a similar
22 material for all of those features, like around Fort
23 Simpson.

24 Q Is that because that's
25 what's available there?

26 A That's correct.

27 I guess the point is, that I'm trying to make, is that
28 our optimum design of compressor station pad would
29 involve the use of good clean free-draining gravel,
30 but we could design it with a till or sand or almost

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

1
2 any material other than organic.

3 Q Now, I'm referring back
4 again to the figure that you have developed of 30
5 million cubic yards, and you mentioned, Miss Minning,
6 I think in cross-examination from Mr. Hollingworth
7 that for looping your estimates of the requirements
8 are far less than those that were presented to you
9 by the government. You estimated something like an
10 additional 6 or 7 million cubic yards.

11 WITNESS MINNING: I think the
12 number was six million.

13 Q And they estimated
14 doubling the requirement.

15 A Double, yes.

16 Q And you felt that what
17 they had overlooked was that you don't have to build
18 roads twice, or air strips twice, is that true?

19 A Or station pads.

20 Q Yes, although if you
21 were putting in additional stations, I assume you
22 would need additional station pads.

23 WITNESS CLARK: I don't
24 believe the looping program would involve additional
25 stations. I think we would make use of the existing
26 pads.

27 Q Now this refers, this
28 six million cubic yards, refers to a single looping,
29 in other words a full looping of the entire line, does
30 it, the six million cubic yards?

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

A I believe it does. We haven't done a rigorous study of the requirements for looping.

Q Well, where does that figure come from, Dr. Clark?

A It comes from a quick assessment of what we have now, but it's unrelated to station sites, air strips and permanent roads.

Q All right, so what it really is is borrow requirements for either select backfill or the additional berm that would be required on the twinned pipe, is that correct?

A I believe that's correct.

Q And this doesn't anticipate a possibility of a line being looped more than twice as has happened in certain lines in Southern Canada.

A No, it doesn't. I believe probably the next increment would be somewhat higher because the increase in stations size would probably be required, but I don't know that.

Q And not only that, but I would assume that once you get to that stage you are probably anticipating additional facilities which would require some borrow material as well. You may in fact have to twin the air strip at a certain place because of the amount of activity, or double the size of the road. Would that be fair to say?

MR. MARSHALL: Well, Mr. Bayly, there's really no anticipation of that sort of activity

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning
Williams
CrossExam by Bayly

1 at all.
2

3 M R. BAYLY: I realize that,
4 Mr. Commissioner. I'm just suggesting that although
5 it hasn't been put into the calculations, because it
6 has happened in pipelines in other parts of Canada
7 it is a possibility, and Dr. Clark has, I think, under-
8 stood that I'm not suggesting that Arctic Gas is
9 planning to run three lines down their right-of-way.
10 I just want to know, because I'm interested in borrow
11 requirements, that are only there in finite borrow
12 quantities, we can't ship them in like pipe, I'm assum-
13 ing.

14 A That's correct. I think
15 it's fair to say also that the thought of a third
16 looping has never entered my mind until you mentioned
17 it a moment ago. So that any discussion we have on it
18 will be purely that of discussion, without having given any
19 thought to it.

20 Q That's fair enough.
21 In order to set Mr. Marshall's mind at rest, perhaps
22 we could turn from that to an oil pipeline, which I
23 am assuming has been in your mind as if not a competitor
24 for the gravel borrow, at least a subsequent user of
25 the resources or some of them that are in the area.
26 Is that correct?

27 A Yes, that's correct.

28 Q Now, perhaps Miss Minning
29 can answer this because I understand she has been the
30 one who has been looking at the sites during the summer-

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
~~Cross~~-Exam by Bayly

1 time. Miss Minning, have you looked at these sites
2 with the view to gravel availability for a second
3 utility, using a similar or the same corridor as the
4 gas pipeline?

5 WITNESS MINNING: We were
6 looking at the sites in terms of how much material is
7 there in the sites. In many cases there is more than
8 double the material that we require in each site. So,
9 I think you could say we're looking at the total site,
10 we're not just looking at our little part of the site.

11 Q All right, so when you
12 say "more than double your requirements", then you
13 would anticipate that there would be another 30 million
14 cubic yards for the oil pipeline.

15 A I would say in many of
16 the sites that would be true.

17 Q All right, but we do face
18 that same problem, I gather in certain areas that
19 where you have shortages, the shortages for the next
20 user, if anything, will be more critical and the hauls
21 will be longer. For example, in the Parsons Lake area.

22 A Yes, that's probably
23 true.

24 Q Now, the reason I asked
25 that is I'd like to get you into discussing gravel
26 not as a total commodity for the project, because I
27 think we both agree that 30 million cubic yards in the
28 entire Mackenzie Valley is not a great deal of material
29 to use in terms of the total resource. Is that fair to
30 say?

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

A Yes.

Q And where the real problems exist, are not in total shortages but in local shortages caused by the first user using the available material and forcing the second user either to do long hauls, or to have to use material that he would rather not use. I'm including in that not only the pipeline -- oil pipeline possibility, but communities, roads, railroads, or whoever might, at a later time, want to use granular material.

A That's true.

Q And have you identified areas in which the problem of those kinds of shortages appear to be critical?

A Yes, we're aware of the areas where there are shortages.

Q All right, and what are the areas that you feel on the prime route are areas where either you will face shortages, or long hauls, or the subsequent users will?

A I would like to look at something first. O.K.?

Q All right.

A We find that in pipeline mile zero to 172, depending on where you are, there could be some possible problems. This is the northern end of the pipeline.

Q Would you explain what you mean by "depending on where you are"?

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

A Depending on where there is gravel and sand and there is bedrock there in certain areas, but some places along that mileage you can run into problems.

Q All right.

A Everybody wants to do everything at the same spot, yes.

Q That's along the North Slope?

A No, this is along the east side of the delta, there is no problem on the North Slope.

Q All right, so along the east side of the delta there may be problems.

A That is correct.

Q Now, and that is an area in which there would be your facility definitely, and definitely the producer facilities -- gas processing plants and whatever roads and support facilities they require; is that correct?

A That is correct, that is the northern part of that, yes.

Q All right now, what does "shortage" mean to a gravel person? That's a vague question, I know, but what I'm trying to get at is what sort of hauls, for example, would be envisaged because of these shortages? What length of hauls?

A I think presently on our strip maps we've tried to stay outside of hauling eight

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

1 miles, but presently people in the vicinity of Fort
2 Simpson are hauling gravel over 12 to 18 miles to get
3 to the townsite for construction of the highway, so I
4 would say that's a longer haul and possibly if you
5 need only a minor amount of gravel to haul it long
6 distances probably is not that critical.

7 Q All right, and is this
8 something that you as a gravel person from Arctic Gas
9 discusses with the producers to see what sort of
10 requirements they will have and where you will be
11 competing with them?

12 A Yes, we are aware of
13 what they are doing. For example; they are doing a
14 detailed study in the Ya-Ya Lakes area of material
15 present there. We are aware of this study.

16 Q All right, and when you
17 say "the Ya-Ya Lakes area" I gather there is a large
18 esker deposit at the Ya-Ya Lakes that everybody eyes
19 with some envy.

20 A Something like that, yes.

21 Q And in terms of, you
22 called this a critical area because you will be compet-
23 ing for this material. Will it mean that you'll have
24 to sacrifice the kinds of materials you would be the
25 most happy with and take materials that would be
26 second best?

27 A That's true.

28 Q All right, what materials
29 would you have a shortage of?
30

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

1 A There is plenty of
2 sand in that country, but not so much gravel. This is
3 the sort of thing.

4 Q Would you therefore have
5 to substitute sand for gravel? In other words, rather
6 than using sand -- gravel -- would you have to use sand
7 in some places?

8 A Yes.

9 Q And would that include
10 for use for road beds and airstrip facilities?

11 A Sure.

12 Q And is that satisfactory
13 material for those? Can it actually be used, or are
14 you going to run into some real problems using sand
15 for roads, for example?

16 WITNESS CLARK: Sand can be
17 roads, airstrips and
18 use for/compressor station sites.

19 Q As I understand, though,
20 you will, say with a sand airstrip run into some
21 problems at certain seasons of the year that you
22 wouldn't have with a coarser grained material.

23 A No, there are techniques
24 of upgrading marginally acceptable soils of sands or
25 silts. For instance, the use of soil cement. That's
26 extensively used in some places in the world where
27 they haven't got gravel really. There are other
28 methods of stabilizing surfaces. If you're thinking of
29 loss of support or erosion, they can be designed for.

30 Q Would you anticipate
using what you're calling soil cement in the Tuk

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

1 Peninsula area?

2 A It might be required.

3 Q And what sort of chemi-
4 cals, if any, are involved in soil cement?

5 A Well, the cement is made
6 from -- predominantly from limestone.

7 Q It is a cement?

8 A It's the same cement
9 that you'd use in your basement, only it's used in much
10 smaller quantities.

11 Q So it's really a sand
12 that has some rigidity.

13 A A bit of binder, yes.

14 Q It's like a fine mortar
15 then really.

16 A That's correct.. Quantities
17 range from about three to maybe as high as 15% by
18 weight, but that's exceptional. That's more ^{or} silt that
19 would require that high a quantity.

20 Q And where would this be
21 produced? Is this something that would be produced
22 locally in a cement plant?

23 A This soil cement?

24 Q Yes.

25 A Oh, it's mixed right in
26 place.

27 Q All right, but I gather
28 cement gets manufactured.

29 A Yes.
30

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

Q Would you anticipate it being manufactured locally or being brought in as one of the construction materials?

A We have not reached the point where we've looked at that, mainly because we haven't identified any areas that would require soil cement. The quantities involved, I would think that they would be shipped in/ somewhere where it's made.

Q Now, I gather we could use adjectives to describe sand and some sand is coarse; another is fine-grained and some sand is silty. What sort of sand are we talking about in this area on the east side of the Mackenzie delta?

A I believe they're fairly fine there.

Q So, as I understand as well, there were some problems on the Mackenzie Highway with the use of certain fine-grained silts and silty sands that caused, or that were prone to washouts. Is this the same kind of material, or is this a material which is better than that?

A Oh, the sand is much -- can be eroded more quickly and with less water flow than could the gravel, for instance.

Q Now, how would this kind of sand respond to say a bad storm which caused inland surges?

A It could be protected by some type of riprap or surface treatment.

Clark, Dabbs, Barton, Bennett,
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

Q And what sort of --

I understand riprap -- but will you tell me what sort of surface treatment you would, in your experience, feel might be used?

A There are stabilizing asphaltic emulsions, for instance, that --

Q So that's sort of an oily black substance, is it?

A Not an oily black substance. The vehicle is water.

Q Yes, but asphalt is --

A It's an emulsion.

Q And looks like tar?

A yes, that's right.

Q I'm not trying to be inflammatory, I'm just trying to figure out what you're talking about.

A No, it's a mixture of water and tar, plus an agent that contributes to the emulsification. It's emulsified suspension, one of several methods that's used for surface stabilization.

Q That can bind the surface how much, an inch or two?

A If it's sprayed on, it's a fraction of an inch; if it's mixed and bladed into place it could be several inches.

Q Now, either, Dr. Clark or Miss Minning, this question is directed at as to whether you consulted with anyone other than the producers and

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

1 the government with regard to their granular material
2 means. For example, say the Community of Inuvik, which
3 I understand has some gravel problems of its own.
4

5 A Well, maybe you could --
6 as I understand the DIAND granular inventory was related
7 to -- it was carried out in a couple of phases. One
8 related to community areas, and the other, the general
9 overall Mackenzie Valley. The report that was produced
10 predicted community needs, producer needs, pipeline
11 company needs, highway needs and so on. This
12 compilation that we've talked about has taken those
13 into account.

14 Q All right now, I notice
15 you referred/^{it}partly to Miss Minning, and I wonder if
16 she was actually in contact with people in Inuvik on
17 her summer work, and talked to them about Arctic Gas'
18 granular requirements in relation to their own.

19 WITNESS MINNING: No, this
20 is part of this next phase of work that we were speaking
21 of before yesterday.

22 Q In other words, now
23 that you've identified --

24 A You first have to identify
25 areas where borrow might be taken, where we need borrow
26 and this sort of thing. Now the next phase is to go
27 and ask. It's sometimes very difficult to find out where
28 the Mackenzie Highway wants to take material and this
29 sort of thing.

30 Q I understand some people

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

1 in Inuvik and Tuk want some sort of a permanent road
2 facility linking the two communities, and I would
3 assume if that were a project that the people wanted to
4 go ahead with, it would require granular materials, again,
5 in an area where there seemed to be shortages and re-
6 quirements to substitute.

7
8 A From what I understand
9 that road is slightly different from ours in that
10 area.

11 Q When you say "slightly",

12 --

13 A I doubt if the same
14 deposits would be used.

15 Q So they would be more
16 than eight miles away from your facility.

17 A I'm not positive of the
18 alignment of the road, but I think I've seen it some-
19 where, and I don't think it corresponds with our line
20 and we probably would not be using the same sources.
21 They don't like to go much more than eight miles either,
22 I don't think.

23 Q That would put them
24 16 miles apart then, if they weren't going to use the
25 same sources and they use your test of eight miles as
26 the longest haul that you would like to use.

27 A I think we expect that
28 some hauls will be more than eight miles. I think
29 some probably will.

30 Q Yes. Now, long ago,
that is in March, we had Dr. Mollard here talking about

Clark, Dabbs, Harlan, Hemsted
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

his survey of granular material, and I'd like to refer to what he said in his assessment of granular materials supplies in the area we've just been talking about, and see if you used the same methods or whether you used different or additional methods. I'm referring to the transcript, Volume 17 for March 13, 1975, at page 1977, and in response to a question on page 1976, and the question was:

"Is one of the gravel deposit areas that you've recommended as being a prime source in that reported located near Travaillant Lake?"

Would you like a copy of that volume? The reason I say that is because Dr. Mollard gives long answers and rather than reading them all into the record again you might have a look and see if my synopsis of the answer is a fair one and comment on it.

If it is not available, I'll read the entire response. The question regarding borrow source near Travaillant lake is answered as follows; starting at page 1976:

"There are a number, as I recall, and I would have to go back by memory, and my memory would say that, yes, it is here, but I can remember it will just confuse me.

Q It is on page 3, Dr. Mollard, in case I can confuse you further.

A Yes, for example if you take Travaillant Lake in its broadest, you know, context of an area, and I have not really looked at the report,

Clark, Dabbs, Harlan, Hemstock
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

1 this morning, there are a number of fairly large
2 deposits which I think are substantial, such as
3 north of Hans Creek, and then there is a large
4 outwater channel about eight miles north-east of
5 Little Chicago, which I think probably has 15
6 million cubic yards in it and then there are
7 large deposits if I remember correctly at Sunny
8 Lake, and another lake which starts with an S,
9 I forget the name of the lake, and Big Stone
10 Lake. There is another deposit in there quite
11 substantial and those are in the vicinity of
12 Travaillant Lake; and I think if I can remember
13 correctly, there is a fairly substantial deposit
14 somewhat south and east, not too far from
15 Travaillant Lake, so those, in my view, are
16 quite substantial deposits in the order of
17 possibly 10 million cubic yards or more. That
18 is an estimate without a great deal of drilling.
19 I would assume you would have to do some
20 drilling, but I sort of classify them in terms
21 of the ones that I can remember, which are large
22 and look good, versus dozens which are marginal
23 and sort of doubtful. "

24
25 Now it's that particular method of assessment of the
26 deposits which I am assuming you have updated by
27 doing more work than just looking at them. Is that
28 correct?

29 A That's correct. We've
30 used air photos, just like Dr. Mollard has, in his

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning
Williams
Cross-Exam by Bayly

1
2 borrow work. We've also used the government granular
3 inventory of materials which does cover that area,
4 which does predict how much each deposit has. We hope
5 we have chosen deposits that have enough, I might add
6 we've made several mistakes.

7 Q All right, have you been
8 drilling these deposits --

9 A And also this summer that
10 was an area that we checked again and we've drilled
11 some of those deposits, in fact that was one of the
12 areas that we hit with quite a few drillings and test-
13 pitting.

14 Q Well, when you say you've
15 done some drilling, would you feel that you require
16 more drilling before you can properly assess what's
17 there that you need?

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Clark, Dabbs, Harlan, Hemstock,
Koskimaki McCart, Minning,
Williams.

Cross - Exam by Bayly

A I don't think we need more
drilling to access that. Before you develop a site, yes
you need more drilling.

Q And that is on a site by
site basis?

A That is correct.

Q Now Dr. Mollard goes on on
page 1978 to refer to the Ya Ya esker that you referred
to as being a classic deposit and he made it sound
rather unique. Is it unique in that area? He says and
they have an answer to a question on line eleven of that
page, "Yes well there are a number of very major deposits
on Richards Island. the Ya Ya esker being a classic. Are
we looking at an area which has a few large deposits
fairly widely spaced?

A I think that is the sort of
an area. I would say that that isn't. In the Richards
Island area there is not alot of good material.

Q All right.

A And what is present is
probably present in a deposit like that one.

Q And if you wanted to use
that kind of material then or felt you had to for
certain purposes, you would be faced with long hauls,
longer hauls than you might want to make?

A That is probably true.

Q Would you be faced with long
hauls on permanent roads or temporary roads?

A Temporary roads.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams.

Cross - Exam by Bayly

Q Dr. Mollard also on page
1979 referring to this critical lake defines it in a bit
more detail than I have and I am referring to line one
of 1979 where he says, "But really from several miles
south of Parsons Lake to just south of Campbell Lake, it
would be what I consider an area where there are
relatively few. There are, I might use the expression,
piddly small deposits which no self respecting contractor
would go into, but they exist". Are these the deposits
that you are referring to as the secondary or second
grade sources that you might be forced to use?

A Possibly I would like to
look at that in more detail that area before I would
comment.

Q Of the transcript or of the
country?

A No, along the strip maps.

Q But you would agree with him,
that some of these are pretty poor deposits?

A That is correct.

Q Can you tell me just whether
you remember the requirements that the producers would
have for their initial facilities in that area, how much
granular material they would need?

A Which area are you speaking
of now?

Q I am talking about this area
particularly south of Parsons Lake to just south of
Campbell Lake. They will I assume need some material in

Clark Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams.

Cross - Exam by Bayly

the Parsons Lake area to build a gas plant, plus roads,
plus air strips.

A My recollection is that that
activity will take place east of where the pipe line is.

Q All right. It may take place
east, but will they require borrow granular materials
from the same sources that you will?

A I am not sure of the answer
to that question.

Q Okay.

A I am not sure what the
producers need there. I would have to know that first.

Q Is that something you would
have easy access to, say over the lunch hour, or...

MR. HEMSTOCK I might comment

we have formed a committee with the producers to look
at this problem and other problems of co-ordination in the
Delta area and we can check, but I am quite sure we don't
have the information yet for the requirements for Gulf
at Parsons Lake but we can certainly check that.

MR. BAYLY. If you could do that
Mr. Hemstock I would be grateful and perhaps, Mr.
Commissioner, Mr. Marshall could inform me if that in-
formation can be received sometime during this panels
cross-examination. I think that would be helpful.

Q I would like to refer again
Miss Minning to Dr. Mollards evidence. At the bottom of
page 1979 I asked him the following question, "All right
now this gravel Dr. Mollard, this gravel deposit east of

Clark Dabbs, Harlan, Hemstock,
Koskimaki, McCart, Minning,
Williams.
Cross - Exam by Bayly

Travaillant Lake interests me", and this is referring to a different deposit from the one we were just discussing.

"Do you know of your own knowledge, or does any of the panel know where this is located and what has been identified by Arctic Gas and others as an ecologically fragile area?" The answer on the next page. "I can't answer that because I don't know the ecologically fragile area". Now in your continuing research into the gravel borrow requirements, did you take people along with you who could identify ecologically fragile areas as they related to the borrow?

A That is correct.

Q Facilities?

A Could you give me the number of this deposit you are referring to? It helps us if we have it to look on the map.

Q I can find it I expect, but I don't have it here.

A Concerned about something in the Sandy Lake area, is that what your concerned about or...

Q My question to Dr. Mollard was in the Travaillant Lake area.

A In the Travaillant Lake area the prime route is west of Travaillant Lake.

Q I realise that. We did have some discussion at that time with the reasons for it being shifted back and forth and I gather that is on the side where there is gravel, is that correct?

Clark, Dabbs. Harlan, Hemstock,
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Williams.
Cross - Exam by Bayly

A Pardon me?

Q That is the side of the lake
with the best gravel?

A No the side of the lake with
the best gravel is to the east of where the prime route
is.

Q Would you have to cross the
lake to get that gravel?

A As far as I know none of the
borrow sites show in that sensitive area.

Q So you would anticipate not
taking gravel out of that area?

A No. No gravel will come
from the Sandy Lake's area, or Sunny Lake I think.

Q Who went? Go ahead.

A Sandy and Sunny.

Q Who went with you this
summer and gave you the advise about which sites should
not be used for ecological reasons?

A Dave Wooley from Renewable
Resources.

Q Dave Wooley?

A Yes he's a mammal person.

Q That must have been quite
a summer.

THE COMMISSIONER: Thank heavens
for that.

MR. MARSHALL: It is somewhat
better than being a gravel person.

Clark, Dabbs, Harlan, Hemstock,
Koskimaki. McCart. Minning,
Williams
Cross - Exam by Bayly

MR. BAYLY: Mr. Commissioner

I think we have arrived at an emotional, if not natural
break and perhaps...

MR. COMMISSIONER: Well we'll
come back at 2:00 then.

MR. MARSHALL: Mr. Commissioner
just before we break Mr. Carter and I have been checking
with Council to see if they had any questions for Mr.
Koskimaki who has been dutifully attending the pro-
ceedings this week and I think it has fielded one question.
We are told by Mr...

MR. COMMISSIONER: He handled it
very well though.

MR. MARSHALL: Yes he received
the witness of the day award and I think one day he had
no questions and fielded all of them with great dispatch
and dexterity and we have given him the award for that
day. Anyway, Mr. Scott and Mr. Hollingworth and Mr. Veale,
Mr. Bell and Mr. Anthony have indicated that they do
not feel that they have questions for Mr. Koskimaki.
Maybe I got the information wrong. Mr. Bayly wants to
check over the noon hour, he is not certain whether he
does or not.

MR. SCOTT: I said I would like
to discuss it with you Mr. Carter at lunch. I did not
want you to conclude from that that there was no question.

MR. MARSHALL: Oh did you....

MR. SCOTT: No that won't be
necessary.

Clark Dabbs Harlan. Hemstock,
Koskimaki, McCart Minning.
Williams.
Cross - Exam by Bayly

MR. MARSHALL: I will accept
Mr. Scott's invitation then but Sir if none of the counsel
have questions, Mr. Koskimaki would, unless you require
his attendance for the rest of the week, like to get
back to some meetings that were scheduled with some people.
So I will check with the balance of counsel and if any
of them think up questions over the lunch hour, ^{they could} let me
know otherwise, we will let him go.

MR. COMMISSIONER: Alright, that
is fine with me and if Mr. Scott releases you, Mr.
Koskimaki, you are free to leave and we thank you for
coming and enlightening us. So, we will adjourn to 2:00.

(PROCEEDINGS ADJOURNED TILL 2:00 P.M.)

Clark, Dabbs, Harlan, Hemstock
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(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR. MARSHALL: Mr. Commissioner,
I have checked with the counsel and none of them have
questions for Mr. Koskimaki so with your leave, then
we will let him step down from the panel.

COMMISSIONER: Certainly.

MR. MARSHALL: If during the
course of the cross-examination the panel by the
remaining counsel, there are some questions on air
quality. Mr. Hemstock could answer those I think.

COMMISSIONER: Fine.

(KOSKIMAKI ASIDE)

THE COMMISSIONER: I hope
Mr. Koskimaki doesn't misunderstand if I say I view
this as progress.

MR. SCOTT: Mr. Commissioner,
I refer to all counsel I have another list of
documents but Dr. Fyles and I aren't quite sure exactly
what it is we have circulated yet so we will tell them
tomorrow.

MR. BAYLY: Miss Minning, I
understand from your counsel that you have checked into
the, I believe it is the Sandy and Sunny Lake areas
and the deposits there and have some comments to
make by way of clarification.

WITNESS MINNING: We have
shown our borrow site GML40 just south of Sunny Lake
with an esker. We are only going to require 2,000
cubic yards of material for use in a tower which may

Clark, Dabbs, Harlan, Femstock
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never be built if we go to satellites.

Q So, what you are hoping to do is set that aside, are you, just in case you want to use this kind of communication facility?

A That is correct.

Q Arctic Gas, as I understand it, has responded to the government concern on the general supply of granular materials and I am referring to the concern found at page 360 of the Assessment Groups Report which I believe you have in front of you.

Looking at the paragraph entitled "General Supply of Granular Materials", the concern appears to be that it is possible that other potential users of granular materials may find that the ones that they would like to use are not there when they go to use them. Now, Arctic Gas has responded in the responses under question 9, 9-1. It is just past those maps. At the bottom of the second paragraph in question 9. Have you found that question? Miss Minning, do you have the reference?

A Yes.

Q Now, the response is that "It is the intention of the applicant to cooperate fully in the allocation, use and conservation of granular material deposits with the government or other regulatory bodies which will be responsible for the allocation of such material deposits."

Now, what this response

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1
2 doesn't say and I would like your comment on is that
3 it may be a concern that the applicant was used in
4 first person, the very best when perhaps in some areas
5 the second best would be adequate making it difficult
6 for subsequent users that might need a better quality
7 of material to build whatever facilities they may
8 want. You can use, if you like, the Fort Good Hope
9 example that Mr. Bell went into today. Do you
10 understand that there may be, you may be able to use
11 one quality of material but might prefer another? And
12 being the first one there, you have the first chance
13 to get at it?

14 A Well, in handing in our
15 estimates of types of material required to DIAND, we
16 did not ask totally for number 1 material. We tried to
17 put the specifications that we thought were necessary
18 on it and asked for some of everything so that we
19 would not be asking for all of the best borrow.

20 Q Have you asked for the
21 best that you think you need for a project? Or how
22 have you done that, because there must be in some parts of
23 your project two or three kinds of granular or other
24 kinds of material you could use? Is that correct?

25 A That is correct.

26 Q And, in fact, in some
27 areas, you will have to make do with some that may
28 be one or two grades down from what you would like to
29 use?

30 A That is correct.

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1
2 Q Well then, when you
3 put in your requirements and your desires to use
4 certain kinds of materials despite the fact that you
5 have not always asked for number 1 grade, have there
6 been occasions that you have asked for grades that will
7 make it very difficult for anyone else who needs that
8 kind of material to use it in an area?

9 A I don't think so.

10 Q How did you go about
11 doing this? How did you go about assessing the
12 other needs for example?

13 A As I said before, each
14 of the deposits that were chosen were chosen because
15 there was an excess of our requirements in the deposit.

16 Q I can understand that
17 but I can also envisage a situation where you would
18 need a thousand cubic yards and there would be 1,100
19 cubic yards in the deposit, leaving 100 cubic yards
20 which might not be very useful to anybody?

21 A I think one of the
22 philosophies too, was not to open large numbers of
23 deposits to get a little bit here and a little bit
24 there. This was another philosophy, I think, that
25 should be probably stated at this time. In other words
26 if you had one large deposit in one place and you
27 were to take the granular material from that and there
28 was quite a bit left, that would be an area where you
29 would be able to go back whoever another user would
30 be. But if you take two or three deposits and try to

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1
2 make your quantities from those deposits, then you
3 are running into more excavations and that sort of
4 thing. And that is another philosophy. You are taking
5 good deposits and then taking big deposits.
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Clark, Dabbs, Harlan, Hemstock
McCart, Minning
Williams
Cross-Exam by Bayly

1
2 WITNESS MINNING: So other
3 people might be very interested in it too.

4 Q Your philosophy has been
5 to open as few pits as possible, as well as to take
6 only the kinds of materials that you absolutely require
7 for various uses.

8 A That is correct.

9 Q It would be possible,
10 however, I take it, to have adopted a different
11 philosophy in some areas anyway and to take small
12 amounts from a larger number of sources.

13 A Yes, I think that would
14 be acceptable to us. That's what is required.

15 Q Now, did you get any
16 guidelines in developing this philosophy, or was it
17 something that Arctic Gas generated for you, or do
18 you have any knowledge of that?

19 A Well, I don't like to
20 call myself an environmentalist because I'm a geologist,
21 and I don't know if they really are environmentalists,
22 but I'd say that it's common sense if you're not wanting
23 to make holes everywhere, you'd go into fewer deposits.

24 Q All right, was it your
25 common sense, or were you directed when you were
26 looking for granular resources to direct your mind
27 to opening as few gravel pits as possible.

28 A I think I discussed this
29 matter with other people. Les Williams is one of
30 these people.

Clark, Dabbs, Harlan, Hemstock
McCart, Minning
Williams
Cross-Exam by Bayly

1
2 Q Mr. Williams, why do we
3 open fewer pits rather than a larger number of smaller
4 pits from an environmentalist point of view?

5 WITNESS WILLIAMS: From an
6 environmentalist point of view.

7 Q Well, actually from your
8 own point of view, Mr. Williams, it's just that you've
9 been qualified as an environmentalist, I understand.

10 A I think that the fewer
11 you open, the better control you can exert, Mr.
12 Bayly. To put in -- to implement the required procedures
13 similar to what Miss Minning showed in her slides of
14 what was happening on the Alyeska situation, or putting
15 in berms, spilling basins and what-not, I think it's
16 more economic having to do this less frequently.
17 I would think from an aesthetic point of view that
18 it's probably better to have fewer scars on the
19 countryside. I don't know from a mammal aspect, maybe
20 you disturb fewer potential dens because this is the
21 kind of material that they do get into that's normally
22 thawed deeper. I can't think of anything else offhand.

23 Q What about Dr. Dabbs,
24 perhaps you might have a comment on this from the point
25 of view of having to re-vegetate as many of these
26 borrow facilities as can be reclaimed by planting
27 things on them.

28 WITNESS DABBS: I don't
29 believe I can really add anything more to what has
30 been said by Mr. Williams.

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
CrossExam by Bayly

1 A Presumably if the large
2 area was very large -- I don't have any idea of what
3 that measure might be -- then of course it places the
4 centre of the borrow pit further from the outer edges
5 of the undisturbed community and making it somewhat
6 less accessible for propagules of plants to arrive in
7 that area; but I'm not aware of any borrow site that
8 would be so large as to actually amount to that
9 situation.

10 Q So you don't see that
11 as a significant reason for any particular size of
12 borrow facility?

13 A I don't see that as a
14 reason. One point I might add, that if there are fewer
15 and larger areas it might be easier for me to argue that
16 it might be somewhat more expensive, more elaborate
17 re-contouring and ^alater cleanup of fewer areas than
18 a large number of small areas scattered throughout
19 the country. But I doubt that that would even be a
20 problem unless it's a commitment on the part of
21 Arctic Gas to do these things.
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Clark, Dabbs, Harlan, Hemstock,
McCart, Minning Williams
Cross-Exam by Bayly

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Q One of the concerns with
regards to material you may put on the on the berm, is
4 that it will not likely be entirely granular material,
5 therefore when you put it on it may possibly have water
and snow in it. Is that a good possibility? Perhaps
7 Dr. Clark could address himself to that.

A Yes that is a possibility.

Q And do you envisage erosion
problems as a possible result of placing borrowed material,
especially the more fine grained material on top of the
berm?

A No, our erosion control
14 measures that are designed are based on considering bare
soil conditions. In other words, we are not designing
the protective measures counting on the vegetation in the
early stages. So that if there was a potential for
erosion, it would be more related to the slope angles and
nature of the material rather than the snow that might
get into it. There would be obviously a ditch is to be
to fill with snow on occasion and it has to be emptied
21 out before it goes back in. Snow will cover the spoil
mound and some would get mixed in but I don't think it
24 would clear in sufficient quantities in itself to create
an erosion problem greater than exists from the other
features.

Q What about the problem of
when you excavate the material, either from the pit or
from the ditch, of it being in large chunks, that when
they are piled back on will create water traps or snow

Clark. Dabbs. Harlan. Herstock.
McCart. Minning, Williams.
Cross-Exam by Bayly

traps that in the spring time and in the absence of vegetation may cause local erosion problems?

A Yes we would expect that there would be a thawing above the pipe in the inactive season and that portion of the berm would settle. It wouldn't settle below the original ground surface however unless it were extremely ice rich and in a very high ice content soils we are proposed to import back fill material there.

Q Well would you contemplate the possibility of pulverizing some of this material before putting it on or treating it the way you do in a, say a gravel sizing or a crushing operation?

A We have discussed and looked at the possibility of some processing to take out fine material out of the spoil to use as bedding but we wouldn't count on pulverizing it. The way it comes out from the ditch, or from the trials that have been run indicates that it is at a fairly convenient size now. We would make this on the material where we have been able to do it at the ditcher test site to determine how much bulking occurs when it is excavated. There is also the pipe line itself displaces about twelve cubic feet per foot of length and that is what all goes in to making up the mound.

Q That and the amount of back fill that you would anticipate, sorry not back fill, but borrow material that you would anticipate putting on to create the average size berm that you...

Clark, Dabbs, Harlan, Hemstock
McCart, Minning Williams.
Cross-Exam by Bayly

A No, we wouldn't bring in material to build a berm except in those areas where we would build the type of berm to provide over-burden pressure for frost heave.

Q Now are ^{you} going to get your three foot berm just from the material that is actually excavated? Or is it going...

A Oh the three foot berm. when I used ~~that~~ that number of three feet this morning that was an average for a surcharge load. It would be about three feet high and about 45 feet across as an average. The spoil mound itself will have a height of two to three feet, will extend beyond the edges of the ditch and that comes from the twelve cubic feet per foot displaced by the pipe as well as the fact that it occupies a larger volume after it is excavated. It has a higher porosity if you like.

Q Yes and that will settle I gather eventually into something more compacted over the years.

A Something more compact, but probably not as compact as it was in its original state.

Q Yes. Miss Minning, have you looked into the kind of equipment that will be required to treat granular materials? You have talked about having to take bedrock. I assume that bedrock has to be subdivided and crushed perhaps?

A I am not in this myself. Other people in northern engineering have done this and

Clark, Dabbs, Harlan, Hemstock,
McCart, Minning, Williams,
Cross-Exam by Bayly

perhaps Mr. Williams would like to describe these machines.

MP. WILLIAMS. We have looked at crushing machines, Mr. Bailey, for, certainly for, they will be required for quarry operations, no question. We have also had a few discussions with crusher manufacturers to investigate the possibility of crushing the spoil as you earlier had suggested, not only to reduce the size of the particles but to provide bedding material where it is required, where the ditch bottom is uneven. But that is about as far as we have gone. We just haven't had discussions and when your talking about the large particles and the large lumps, this is why we like the wheel ditching machine, is because it does bring it out in smaller lumps and even where blasting is required and I am not talking about bedrock blasting now but blasting in other areas. We would also like there, where possible, to use the ditching machines to excavate the blasted material because it also tends to break up the larger chunks from blasting but that won't be possible in all cases and backhoe work will be required and that tends to give you pretty large lumps.

Q Yes.

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 Q You will, I anticipate,
2 in some areas as well have to have sorting as well as
3 washing of equipment where you're going to use certain
4 aggregates for concrete purposes. Is that correct?

5 WITNESS WILLIAMS: Yes, I would
6 think it would be required in some areas. I don't
7 see it extensively used, because as I say, the concrete
8 for concrete weights, it's just a weight is all that
9 you're making. The structural strength is not really
10 important. It doesn't have to be high quality concrete,
11 and you can overcome some of the problem by putting in
12 more cement into the concrete, or more reinforcing.

13 Q I gather they have to be
14 better than the ones we saw on the west coast photographs.

15 A I'm not sure, and I don't
16 think it was said whether that was a freezing problem
17 or a poor aggregate problem, or an insufficient mixing
18 problem. I suspect it was a freezing problem.

19 Q Yes, Miss Minning,
20 did you on your trip this summer investigate sources
21 of granular materials that might be used if the
22 cross-delta route is adopted by Arctic Gas and if so,
23 where are they?

24 WITNESS MINNING: Yes, we
25 did. There's abundant granular material on the west
26 side of the delta in the Yukon coastal plain area of
27 all types. On the east side of the delta, as was
28 mentioned before, there are fewer deposits. We have
29 looked at some of those deposits again.

30 Q All right, can you now --

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 A Over and above what has
2 been looked at by the granular materials inventory.

3 Q And will you be providing
4 your counsel with a list of these sites and marking
5 them "preferred" and "alternate" for the purpose of the
6 cross-delta -- I hesitate to call it a phase, Mr.
7 Commissioner, but whenever that evidence is going to
8 be called?

9 A Yes,

10 Q You've referred in your
11 prepared evidence on page 5 to the necessity for some
12 permanent access roads, and that's down at the bottom
13 of the page where you say:

14 "Borrow pits which will be used during all
15 seasons will have permanent access roads."

16 Now, have you determined as a result of this summer's
17 work among other things, which ones are likely to be
18 used as all year-around access pits?

19 A No, we haven't. The
20 access roads that are permanent appear on the strip
21 maps.

22 Q Nothing has changed since
23 that?

24 A No.

25 Q Is that likely to happen
26 as a result of what you did this summer? In other
27 words, have you identified sources that you like better
28 than ones that were earlier identified?

29 A I don't think that would
30 really affect whether -- would affect the road as such.

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 The idea is to use snow roads in most cases.

2 Q All right.

3 A Whether the deposit
4 changes or not, it doesn't make the road change.

5 Q I'm interested in your
6 summer work from this point of view, Miss Minning.
7 You must have got some estimates from Dr. Mollard. He
8 alluded to certain estimates in certain areas of
9 granular deposits. Did they prove out to be correct
10 in most cases?

11 A You're being pretty
12 general. Could you give me some examples?

13 Q He referred to Little
14 Chicago, as he calls it, as having a very large deposit
15 of some, I believe it's 10 million cubic yards, if I
16 can find that for you. He starts with saying that
17 there are a number of major deposits on Richards Islands
18 the Ya-Ya esker being a classic, as he calls it,
19 Although he doesn't give us a size. Then he goes on
20 to Caribou Mountain and the gravel face which is
21 exposed about 300 feet high and around several miles
22 in length, which is a tertiary gravel. That's on
23 page 1978 of the transcript. Did you check into that
24 deposit to see what he had estimated about Caribou
25 Mountain, whether that was right?

26 A We've looked at the
27 tertiary gravel in that area, in fact you saw a slide
28 here of tertiary gravels in that area.

29 Q Then he goes on and says,
30

Clark, Dabbs, Harlan, Hunt
McCart, Minning, Williams
Cross-Exam by Bayly

1 "And then from there south I think there's
2 one south-east of Noel Lake and then it's
3 pretty skinny,"

4 Did you look at that one?

5 A Yes.

6 Q And is it?

7 A I think it is, yes.

8 Q What does he mean when
9 he says "skinny"? What sort of material could you
10 get there and how much?

11 A I'd like to check that
12 back in the office with the results that we got from
13 the summer. I can't remember every one.

14 Q This will be coming out
15 in your report. Right?

16 A That's correct.

17 Q Then he says:

18 "The one at Inuvik is just about exhausted."
19 Do you agree with that?

20 A That's correct.

21 Q I gather that's one of
22 the kinds of problems that if a pit close to a town
23 like that is exhausted, it means that everybody has
24 to go a long way away to get granular material.

25 MR. MARSHALL: Well, surely
26 that depends on where the next pit is.

27 MR. ANTHONY: I'm taking Inuvik
28 as an example. In fact in that example, Miss Minning,
29 I gather they have to go quite a long way away to the
30 nearest next deposit.

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 A Depends on what kind of
2 material you're speaking of. At least in the Inuvik
3 area there is quite a bit of bedrock which could be
4 crushed to provide borrow material, which is not that
5 far from the town.

6 Q I understand that's
7 where the paragon falcons live.

8 A That's possible.
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McCart, Minning, Williams
Cross-Fxam by Bayly

We would be advised by our
bird consultants before crushing bedrock in the Inuvik
area.

Q I am relieved to hear
that. That would apply throughout the route, I take
it, as a general principle?

A That is correct.

Q I am afraid I can't find
that reference but perhaps when we get into water, I
will be allowed by Mr. Marshall to ask you that.

MR. MARSHALL: Well maybe if
you have a particular deposit in mind, you could ask
her about that, since Miss Minning is here now.

MR. BAYLY: That is what I
have said, Mr. Commissioner. I could not find the
reference to the one that I had wanted and when I do
if I may ask her that I assume she is going to be here
for the water as well as the terrain part of this name.

MR. MARSHALL: I think she
hopes not.

MR. BAYLY: In that case, she
may be back in the Cross-Delta portion to talk about
her report.

MR. MARSHALL: That is possible.

MR. BAYLY: Now, on page 1990
of the transcript Dr. Mollard says that he prefers
borrowing from stream beds on the North Slope, that is
not what we would call the active bed rather than the
terrace or fossil bed of graded streams just from a

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McCart, Minning, Williams
Cross-Exam by Bayly

1 materials point of view. Would you agree with him
2 there? From your look at this as well as your look at
3 material borrowing in Alaska?

4 A I think that is probably
5 true in that the gravel in the part of the river
6 where we showing on the photos, not the water part,
7 is generally not as frozen as the gravel up on the
8 high land areas.

9 Q You did look this summer
10 at terraces didn't you or--

11 A Yes, we did.

12 Q And, my understanding is
13 that you found that there was quite a large amount of
14 granular material that may not have shown up readily
15 from the air but which was evident from the ground.

16 A That is correct.

17 Q And it would be possible,
18 for
19 I take it, to find the North Slope adequate granular
20 resources by using that as a source rather than going
21 into the act of stream beds.

22 MR. MARSHALL: I think you
23 have the same problem I have Mr. Bayly. We keep
24 confusing these. Not the active channel.

25 Q I am talking about the
26 braided stream channel area, not necessarily where the
27 water is but what the active plain, if we can call it
28 that.

29 MR. MARSHALL: The active
30 flood plain, I think, is the term that Dr. Harlan

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1
2 uses. The active flood plain.

3 Q Dr. Harlan, should we use
4 that term?

5 WITNESS HARLAN: Yes.

6 Q All right.

7 WITNESS MINNING: I think you
8 have to consider other factors in going into upland
9 areas too besides--

10 Q I am not suggesting that
11 this is necessarily the best area but I am asking
12 whether if it were the best area you could find enough
13 granular resources in those terraces?

14 A Definitely.

15 Q You could? Now, I
16 understand that in Alaska there were some sites where
17 they actually did this according to the slide show
18 that you presented to us where they took material from
19 the terrace areas?

20 A That is correct.

21 Q Did they run into problems
22 that you observed with the over-burdened material--the
23 tundra mat---did any of that material appear to be
24 in such a place that it could get into streams in a
25 flash flood situation?

26 A I was never there in a
27 flash flood so I can't answer that.

28 Q I realize that even though
29 you weren't there, but how did they cope with the
30 problem of making sure that it was in a safe location,

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1
2 or did they appear to?

3 A I think those slides
4 showed a stock pile area of this tundra on the edges
5 of the borrow site.

6 Q Was it on a river edge,
7 that is the water edge, or was it on the uphill edge?

8 A I would say the best
9 place to put it would be on the uphill edge.

10 Q Is that where they put
11 it?

12 MR. MARSHALL: Well, we can
13 get the slide out if you like, Mr. Bayly. That might
14 be the surest way of finding out if you wish to know
15 that.

16 MR. BAYLY: Q Right, I think
17 the--are the slides the same pictures in the back of
18 this volume "Reconnaissance of the Alyeska Pipeline"?

19 A Some of them are. I
20 think most of them appear in there.

21 Q Do you have a copy of
22 that report because I can't tell from the photographs
23 which--

24 A I am not sure which site
25 you--which thing you are--Are you talking about a
26 fossil flood plain site or a high terrace or what are
27 you speaking of?

28 Q It would be a fossil flood
29 plain site.

30 A Okay. That is page 61.

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

Q From plate 61, we read
the caption being material source pit in fossil flood
plain along the Sagavanirtok River. Can you tell from
that photograph which pile is the organic material?

A It is this dark ring
around it. I think you should note too that there is
a break between that dark ridge and the river proper
in the background.

Q Are you indicating that
the dark ridge in the middle of the page?

A This is a spoil pile
here, but there is also a distance between the spoil
pile and the river proper.

Q So these both black lines
around the pit, if the pit is thought to be a circular
one, would it be surrounded by organic material in
a pile?

A That is correct.

WITNESS DABBS: If I could make
a comment on this. That particular case I am not
familiar with but the likelihood of their being suffi-
cient amount of organic material built up on a fossil
flood plain of any of the rivers draining into the
Beaufort Seas and from the Brooks Range or the British
Mountains is very slight.

THE COMMISSIONER: The likelihood of it
being sufficient organic materials to do what?

A To actually build a
windrow around it. The plant and organic build-up on

Clark, Dabbs, Harlan, Femstock
McCart, Minning, Williams
Cross-Exam by Bayly

1
2 that gravel over the few thousand years the river has
3 changed its course is very small and this particular
4 case in fact has an organic material but the chances
5 are on fossil flood plains that the thickness of plant
6 cover and organic material is so thin as to make it
7 very difficult to peel that back separate from the
8 gravel.
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Clark, Dabbs, Harlan, Hemst
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MR. BAYLY: Was that your experience, Miss Minning, when you looked at these terrace sites, or fossil flood plain sites, that in fact there was very little of this kind of material on top of the gravel?

WITNESS MINNING: I think that depends on certain -- it's more site specific than that. In some places you do get more silt on top of the gravel in a fossil flood plain than in other places, therefore you will have more organic matter. But for the most part it's not as heavily vegetated as an upland site.

Q Well, would it be some- that would have to be removed rather than mixed with the gravel on some sites, in your experience? In other words, I'm understanding from what Dr. Dabbs said, that there's so little of it that you couldn't remove it by itself and you might have to, if you chose that as a borrow site, take the organic material with the granular material.

WITNESS DABBS: I think my comment should be taken -- and I hope I have worded it in a general sense, referring to fossil flood plains generally. As Miss Minning said, on a site specific basis, as an old channel has filled in and built up for a small section or a small area, there could in fact be material that they would want removed.

Q All right. I'm not going to pursue this further. You would think though that if you could remove it and had to, you'd put it uphill

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 of your gravel pit.

2 WITNESS MINNING: That is
3 correct.

4 THE COMMISSIONER: It's out of
5 the question. It's something you won't be able to do,
6 on those fossil flood plains, there's not enough organic
7 material?

8 WITNESS DABBS: It would be
9 very localized, but as I say, generally it's not a
10 situation as you would have in an upland site.

11 MR. BAYLY: Q So then if you
12 were re-vegetating or trying to re-vegetate a borrow
13 pit, it might be very difficult to use that particular
14 organic material to give you a start for your new
15 plants.

16 A That's quite right, yes.

17 Q Now, you went with a
18 biologist on your reconnaissance this summer, Miss
19 Minning, and ⁱⁿ some of your upland sites was it pointed
20 out to you that some of the potential areas may be
21 denning areas, or potential denning areas for foxes
22 and wolves?

23 WITNESS MINNING: Yes.

24 Q Are any of the preferred
25 sites that you encountered actual denning sites?

26 A I don't think I want to
27 -- again, I would rather this would come out in the
28 report. I can't remember from site to site which is
29 and which isn't, and I don't want to say the wrong site.

30 Q But you did see foxes --

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 A I never saw a fox, no.

2 Q But you saw fox denning
3 areas, did you, when you were --

4 A There was evidence of
5 animal life, yes, on some deposits.

6 Q Yes. Now, what sort of
7 criteria have you developed to decide whether or not
8 you would recommend using one of these sites even
9 though it might have fox or wolf denning on it?
10 Now I don't mean that I want you to evaluate it as a
11 fox denning site, but I assume that there are some
12 considerations that have to be made by the gravel
13 person as to whether there is an appropriate site
14 close by, or whether there's as good material that
15 can be used from some other source.

16 A Yes, I think in certain
17 cases too the way a site is developed I think we have
18 some ground rules for developing an upland site. For
19 example you might want to stick to the north side of
20 a deposit where there are fewer dens and this sort of
21 thing, if you were to develop the deposit.

22 Q That works if you only
23 take the north side, I take it.

24 A That's right. That's
25 the kind of thing we would possibly do in this case
26 of a denning area.

27 Q The borrow facilities
28 and their availability, I take it, have something to
29 do with determining the route. Is that correct,
30 Miss Minning?

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Baytv

1
2 WITNESS WILLIAMS: I would sa
3 almost nil.

4 Q In this particular case?

5 A I'm sorry, in this
6 particular case. There could be exceptions to this
7 rule but in this case it had very little influence
8 on borrow location.

9 Q So in those few areas
10 where you would have long hauls, you're prepared to
11 put up with those for the purpose of leaving the route
12 where it is for various other reasons.

13 A That has been our
14 economic analysis, yes.

15 Q Yes. Now I suppose one
16 of the exceptions to that is the one that you mentioned,
17 Miss Minning, near either Norman Wells or Fort Norman
18 where you were prepared to go across the river and
19 barge gravel across.

20 WITNESS MINNING: This is true,
21 This is where we say that particular thing may have to
22 be done.

23 Q Is that from the Peel
24 or Gravel River, or where is it from?

25 A It's from a terraced
26 and upland borrow site near one of those rivers that
27 runs into the Mackenzie.

28 Q Do you know which one
29 it is?

30 A If I could get my map out.

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 Q Perhaps you could check
2 to see whether it's an alternate or a preferred site.

3 WITNESS WILLIAMS: When you
4 say this is an exception, an exception to what, Mr.
5 Bayly?

6 Q Well, Mr. Williams,
7 perhaps I can tell you what I meant by the question
8 and you can give me an answer to it. If this is a
9 case where a certain amount of distance and inconvenience
10 is involved in order to get granular material to the
11 site where you want it, I'm assuming there's none
12 available close by on the east side of the river so
13 it's going to be contemplated to retrieve it from the
14 west side.

15 A I thought that you were
16 saying that it's an exception to your hypothesis that
17 the route is -- the location of the route is partially
18 governed by the location of the borrow pit. If I
19 accepted that hypothesis, then that would be an
20 exception; but I don't accept it.

21 WITNESS MINNING: At the
22 present time we have not shown this site, as you will
23 notice in the Fort Norman area there is only a stag-
24 ing area stockpile site.

25 Q Yes, I have checked that
26 and --

27 A It's on fine sand and
28 if we were to need gravel in this area, the deposit
29 is on the Little Bear River on the west side of the
30 Mackenzie and it might be necessary to develop this

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 particular site.

2 Q Yes.

3 A It's just not an area
4 of big use at present, that's all. I just mention it as
5 an example of something that might be done.

6 Q All right, and will your
7 report be able to tell us all these things that might
8 be done, or are we at that stage yet when it comes to
9 granular materials? Will you have to go for another
10 summer to assess, or will your report tell us sufficient
11 information that we will know all the preferred and
12 alternate sites that you would contemplate using?

13 A I don't think that will
14 be necessary for this particular exercise. Before any
15 site will be developed, it will be necessary to return
16 to that site.

17 Q What I'm suggesting to
18 you, Miss Minning, is that you aren't going to, after
19 this report comes out, tell us that there are other
20 sites that you might use that you haven't mentioned in
21 the report that hasn't come out yet.

22 MR. MARSHALL: Well, I think,
23 Mr. Bayly, that there very well might be.

24 MR. ANTHONY: Perhaps Miss
25 Minning could answer the question, Mr. Commissioner.

26 WITNESS MINNING: I would say
27 that these sites were chosen in 1973. Since 1973 we
28 have better information, yes. Possibly one of these
29 sites will be changed.

30 Q Well, have you a machinery

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 in mind or a method in mind of informing the people
2 who live in the valley of whether any of these changes
3 are going to be contemplated from time to time?

4 A Most definitely. When
5 these sites are applied for, I imagine before, we will
6 submit a development plan to all the appropriate people,
7 whether they be DIAND people, the highway, whatever,
8 we want to have all the comments possible before we
9 choose the site as the final site.

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Clark, Dabbs, Harlan, Hemstock,
McCarr, Mining Williams.
Cross-Exam by Bayly

Q Have you assessed the various sites you have to see how many of them are on commissioners' land rather than on federal Crown land?

A Yes we have. There are some sites that are on, in development control zones, yes I don't know if that is commissioners land or...

Q But within say the bounds of the community or stipulated area?

A Yes we have. There are sites that are in the bounds of communities, yes.

Q Now do you have to pay for that gravel that is in within the bounds of the community?

MR. WILLIAMS: I would think you would have to pay for any gravel. There is a royalty in the territories for taking gravel. I think from anywhere Mr. Bayly.

Q Yes

A We paid for ^{the} gravel at Sars Sault for instance that we took out of McKenzie River.

Q I realize that there is that. I am just wondering if it has been investigated and whether it is something that goes into choosing sites whether you take gravel from land that has been designated as commissioners land, or land which is still federally...

A Allowances have been made in the cost estimate for the cost of gravel.

Q Okay. So that I assume, Mr Williams, means that somebody has figured out how much it

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams.
Cross-Exam by Bayly

costs?

A An estimate has been made.

Q Yes.

A Not a lot of community contact to see what they would charge though. That has not been done.

Q Yes. Now Miss Minning, if you were going to get additional granular material for the purpose of looping, would you contemplate opening up additional borrow facilities, or would you, or have you already designated ones that you would have to consider reopening?

I
WITNESS MINNING: I think many of the same sites could be used. We have not looked at these sites in terms of providing an exact quantity ^{for} looping but many of these sites have more than the quantities required for us at this time.

Q Well in the event that looping will be required, will you be developing in your report, sources that would be available for this purpose?

Mr. Bayly
MR. WILLIAMS: / could I put in a word please? Northern Engineering has not been asked to do any studies with respect to looping. We have done a few quick things about looping for this hearing. That is just about the extent of our work with looping. Canadian Arctic Gas has not asked Northern Engineering to do looping studies.

Q And does that, one of these quick things, does that include the estimate of the amount

Clark, Dabbs, Harlan Hemstock
 McCart, Minning, Williams.
 Cross-Exam by Bayly

of borrow requirements for looping, this six million cubic yards?

A Yes a very **tertiary** examination.

Q Yes, so is that, that is the extent that we have got to and we have no idea which pits would be used, re-used perhaps?

A Well that would be my opinion. Perhaps Miss Minning has looked at it a little closer than I think but...

Q Well she is with you.

A Yes she is.

Q Miss Minning I don't know if you have something to add. Fine.

MISS MINNING. No.

Q Now if we refer to the application, do you have volume 13A in front of you? 13A.6.7, page 56. This may not be a question particularly for Miss Minning to answer.

A Could you give us the page again please?

Q Yes page 56. 13A.6.7. Now under waste material, we learn that combustible waste will be burned and other materials will be buried on the right of way at stations or other facility sites or the abandoned borrow pits specified by the applicant. Now, can anyone tell me which ones they are, or when they will be specified.

MR. MARSHALL: Well this was gone into

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams,
Cross-Exam by Bayly.

yesterday I think sort of. The panel has given their evidence on this point.

MR. BAYLY: Q I don't think they have given their evidence on when they will specify which borrow pits could be suitable for burial of waste materials unless I am mistaken, Mr. Commissioner. You certainly did elude to the fact that they would contemplate using borrow pits as places to bury materials but I don't think we went any farther than that.

MR. WILLIAMS The study has not been done Mr. Bayly. As we mentioned yesterday with respect to waste water treatment facilities and borrow pit abandonment that it is a site specific study that must be done before, before the action is taken. When we are speaking of burying materials here, it is mainly the materials from the incinerators, the ash and what not, that has not burned, that would be the bulk of the material that might be buried.

Q All right. Now what about other solid wastes? Would they go into these pits as well? I am thinking of machine parts that are broken or tin cans, I suppose those come out of the incinerator, and this sort of thing?

A Yes that is a possibility if it is acceptable to all concerned.

Q But this has not been gone into...

A No, sir.

Q Which wastes materials would

Clark. Dabbs, Harlan, Hemstock
McCart, Minning, Williams.
Cross=Exam by Bayly.

1
2
3 be buried?

4 A As I say, mostly the residue
5 from the incinerator.

6 Q So, these would be borrow
7 facilities which would be necessarily close to a camp
8 which is where the incinerators are contemplated on being.

9 A That would be desirable. not
10 absolutely necessary, but certainly desirable.

11 Q But you wouldn't fly them
12 to pits, You would want to be able to get to them fairly
13 conveniently and on a day to day basis.

14 A But the, the accumulation
15 of this, of most of this material is going to take^{place}/at
16 construction camps in the winter time that will have snow
17 roads probably to the sites. I would see them go by
18 truck.

19 Q Right. Now, I looked at
20 your plans for borrow sites, Miss Minning, that you
21 presented with your evidence and I didn't see anything
22 there as part of the borrow pit development plan that
23 talked about waste disposal. Is that because you picked
24 sites where no waste disposal has been contemplated or
25 do you not consider that part of the site development
26 plan?

27 A These site development plans
28 are typical site development plans. If it were decided
29 on a site specific basis and community accepted it and
30 all this sort of thing, it might appear on the plan. It
31 is not the final plan for the borrow site development,

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly.

at Fort Good Hope or at Oscar Creek or at any of the sites

Q Oh yes. I don't want you to misunderstand my question. What I am thinking of is if the application turns out to be correct, that some waste materials will be buried in abandoned gravel pits, will we know that at the time that you apply to use the pit and present a plan for its development. You certainly have presented a plan for what you call restoration of the pit.

A Yes we would have to know that at that time.

Q Say that again.

THE COMMISSIONER: The answer is yes

MR. BAYLY: Q So these aren't full development plans that you have given us if it were contemplated that you would have to dispose of waste in these pits because that is not included in that? Is that correct?

A That is correct. The specific development plan that was submitted though would have to indicate if it was a disposal area and it would have to be...

Q All right and where do you get your guidelines for what to put in your pit development plan. Do you develop those yourself or does somebody tell you what they want to know about it?

A I am not sure that I understand that.

Q Fine. You have to make an

Clark, Dabbs, Harlan, Herr
McCart, Minning, Williams.
Cross-Exam by Bayly

application to quarry gravel. Correct?

A Yes.

Q And at that time you submit
a plan like the one that you have shown us as an example
in the Fort Good Hope area?

A Yes.

Q And in that plan is it a
requirement that you put in all the uses that you would
make of that pit at the time that you want to open it?

A We would make that assumption
that it is a requirement, if such a requirement
does.
I am not sure if it does or not.

Q But you would be prepared
both
do that as a way of telling the government and others
of all the uses you would intend to make of a gravel pit?

A Yes.

Q Now would it be possible at
some point during this inquiry for us to learn what sorts
of range of materials would be buried in these pits
other than the ones that Mr. Williams has told us about
and I am concerned that there may be materials that may
have different environmental effects or effects on Mr.
Dabbs assortment of grasses and ^{local} ability to grow.

MR. HEMSTOCK: This kind of
thing has been discussed at a meeting in Ottawa, a
seminar and waste disposal and I have suggested that the
materials which would go into these kind of pits would
combustibles and all the organic materials would be
burned in incinerators. The one exception would be large

Clark, Dabbs. Harlan, Hemstock,
McCart, Minning Williams.
Cross-Exam by Bayly

pieces of equipment or machinery and the suggestion there is that the government might set aside stock pile areas along the MacKenzie River to which everyone, government and industry, would haul the larger pieces. These would then be taken outside via barge transport in the summer to be used over again. -

Q Would I be mistaken if I called these junk yards?

A That's what they'll be except that they will include only metal materials and materials which would have some value ⁱⁿ /reclamations.

Q And these would be taken out annually would they. or would they only be taken out when it was economical to do so?

A I don't think it will ever be economical to take them out, It will be, and it will probably be on a as required basis. Any studies that we have done show that it would be quite uneconomical to remove materials.

Q Perhaps we could get their oil drums out to them too?

A The practice so far has been to crush and bury the oil drums and there are some eighty or one hundred thousand have been buried up at Norman Wells.

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 Q Would you be recommending
2 that that continue to be done, that oil barrels be
3 crushed and buried at the various sites that they will
4 be used on the project?

5 WITNESS HEMSTOCK: No, I
6 think we would probably recommend that they be taken
7 back to the point of origin, but we would anticipate
8 using very few.

9 Q You'd be using bulk
10 storage tanks?

11 A In general, that would be
12 the kind of storage required.

13 Q And is part of the present
14 planning for sites of this kind at Kittigazuit and
15 Inuvik part of this, the result of this seminar or
16 the work that led up to it? Work being done by the
17 oil companies, I'm assuming this is --

18 A I couldn't be sure.
19 Certainly it happened after that, so probably that
20 seminar had something to do with it.

21 Q Were there any other
22 recommendations that came out of that seminar, or was
23 that basically what it was about with regard to waste
24 disposal?

25 A I'm sorry, I can't re-
26 call any other recommendations, but I really can't
27 recall much of the detail of it. I would have to
28 check on the proceedings of the seminar.

29 Q You've got copies of
30 those, have you, Mr. Hemstock?

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 A We have them in the
2 office, yes.

3 MR. BAYLY: I haven't checked,
4 Mr. Commissioner, to see whether those are documents
5 that are listed, but I would submit that as they
6 relate to the disposal of products that will be used
7 on this project, that they would be relevant to the
8 Inquiry.

9 WITNESS HEMSTOCK: Let me make
10 it clear that this seminar was not specifically related
11 to this project. It was a general seminar of waste
12 disposal in northern lands and it was before we had
13 any specific concerns with this project; but the
14 proceedings are published in book form.

15 MR. BAYLY: I wasn't suggesting
16 Mr. Commission, that they were anything more than
17 relevant.

18 MR. MARSHALL: Well, if they
19 were published and public, I assume, Mr. Bayly, you
20 will be able to obtain a copy of it somewhere.

21 MR. BAYLY: Perhaps, Mr.
22 Commissioner, if I knew the name of it I would.

23 Q Miss Minning, you touched
24 on the problem of borrow pits that become lakes after
25 they have been used, and in fact one of the examples
26 I believe you gave, the Oscar Creek example, sorry, no,
27 it isn't.

28 WITNESS MINNING: This was in
29 quarry areas, I think we mentioned it was a quarry.
30

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 Q I don't think there is
2 a picture of one, but some quarry areas, you would
3 contemplate, will become -- will have lakes in them.
4 Is that correct?

5 A I would say most would
6 not.

7 Q All right, there will be
8 some that will?

9 A Probably.

10 Q All right, and in those
11 ones I believe you said that you would try and re-
12 vegetate up to the edge of the lakes, is that correct?
13 Or was it you, Dr. Dabbs, that said that?

14 WITNESS DABBS: Yes.

15 Q And when we're talking
16 then about restoration of a gravel pit or a quarry,
17 we're not ever, as I understand it, except possibly
18 in the active flood plains, talking about restoring
19 it to the way it looked before, or almost the way it
20 looked before; is that correct?

21 A Yes, I believe that is
22 right.

23 Q And you would agree
24 with that, Miss Minning?

25 WITNESS MINNING: That is
26 correct, once you take it out and you don't have
27 anything to put in there, you're going to have a hole.

28 Q Right; and is this one
29 of the reasons why the preference in Alaska on the
30 Alyeska project appears to have been for gravel operations

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 in active flood plain areas, because it doesn't leave
2 a scar?

3 A I think that's probably
4 true. I can't say for sure that that was the reason
5 the decision was made.
6

7 Q Because if we take the
8 Sagavanirtok River, that's a river with 46 facilities,
9 borrow facilities, right on the active flood plain,
10 is that correct?

11 A That's correct.
12 MR. BAYLY:
13 So, even if it's not
14 preferred, it's certainly one that's used , the kind
15 of source that's used a lot.

16 Mr. Commissioner, I would
17 propose to leave my questions on ground water sources
18 to the water part of this, but I don't want to be
19 told afterwards that I should have done it now, if that
20 is the case. I notice that Mr. Anthony asked questions
21 in that area during his first cross-examination.

22 MR. SCOTT: It doesn't seem to
23 me, Mr. Commissioner, it matters as long as Mr. Bayly
24 doesn't ask them twice.

25 THE COMMISSIONER: Right.

26 (LAUGHTER)

27 MR. BAYLY: I'll abide by that,
28 Mr. Commissioner.

29 MR. SCOTT: It would frankly,
30 though, be better if he asked them now, if can conven-
iently do so, because we have questions on that matter

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1
2 and if he asks them, well we won't ask them twice.

3 THE COMMISSIONER: Well, let's
4 stop for coffee and you think about it and tell us what
5 you decide.

6 (PROCEEDINGS ADJOURNED FOR FEW MINUTES)

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Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

(PROCEEDINGS RESUMED PURSUANT TO ADJOURNMENT)

MR. MARSHALL: If Mr. Hemstock
was checking for some information on the Gulf
Requirements for borrow. He may be a couple of minutes.
Perhaps if Mr. Bayly's questions are for other members
of the panel, we could just carry on.

O. I can carry on Mr.
Commissioner. Now, page 29 of the evidence of this
panel deals with two areas of significant ground water
activity, one of which is along the Yukon coast and
we have gone into that to a certain extent in the
cross-examination by the Canadian Arctic Resources
Committee. Now, I am referring the panel and perhaps
the appropriate person is Mr. Williams to the response
to the assessment groups concerns, question 52-1 re-
garding water consumption. Do you have that volume?

WITNESS WILLIAMS: Coming
up, sir. Yes, I have it.

O. Now, this page, Mr.
Commissioner, do you have that volume?

THE COMMISSIONER: What volume
is that?

MR. BAYLY: This is the response to
the questions.

THE COMMISSIONER: The brochure
one, yes.

MR. MARSHALL: Here is the
exhibit.

MR. BAYLY: O. Now, if we can refer to

Clarke, Babbs, Barlan, Hens
McCart, Minning, Williams
Cross-Exam by Bayly

page 52-1 of this volume in conjunction with the map that follows page 52-5. It appears that water sources on this map include shallow lakes, deep lakes and rivers but that unlike page 29 of the prepared evidence that no mention is made of ground water sources. Is there an explanation for this?

A I think our plan was was not to use ground water sources for the requirements listed in the response to FAAG question

Q Well, would you need additional water that would be from ground water for things other than those listed in the four categories: snow and ice melt, ditch water, requirements, hydrostatic testing that we don't about.

A I guess rather we should back up and decide what you mean by ground water sources, Mr. Bayly.

Q Well, that is perhaps question that can be answered for me by the panel, Mr. Williams. That is one of the confusing things. It may well be that some of what is identified in the map as river water sources or lake water sources is actually what you would refer to as ground water sources but I can't find it from just looking at this map which appears to identify a potential water use sources. Can you help me?

A That is ground water use sources?

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Baylv

Q Yes.

A Like springs--

Q Well, I am assuming that
is what--

A With substantial flows
in them or--

Q I am assuming that is what
is meant by ground water on page 29 of the prepared
evidence. Is that correct?

WITNESS HARLAN: On areas
such as the Arctic coast, surface water is not indepen-
dent of ground water in that the water will flow from
the river into the ground and then emerge again as a
spring. So, I think in this context, you would
have to regard the use of river water as including
ground water as well.

Q All right. Then perhaps
Dr. Harlan, you could refer to this map and tell me
which water sources are ground water sources that
you would anticipate using for the use as outlined on
52-1?

WITNESS WILLIAMS: I would
say that from that map, when that map was drawn really
there was no intention to use ground water sources.
Unless we are talking about the slide that you saw
where the stream was fed by a substantial flow of
spring water that might be from a deep source that
if you could take some out of it without depleting
the fishery requirement downstream this is a possibility.

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 They aren't identified on this map that it really
2 wasn't considered when that map was drawn.

3 Q So, if there any they
4 would be additional ones. Additional to the ones on
5 this map as possible sources of water?
6

7 A I don't know the location
8 of all these substantial springs, Mr. Bayly. Maybe
9 one of them falls on one of the streams that are
10 crosshatched on the map. I am not sure.

11 Q All right. Now, perhaps
12 either Dr. Harlan or Dr. McCart would know--the only
13 one that appears to be associated with the river on
14 this map is the one on the Firth River. The others
15 all appear to be either deep or shallow lakes.

16 WITNESS HARLAN: There is the
17 Firth and also on the Malcolm. The Malcolm to the
18 west of the Firth.

19 Q I am sorry. You are
20 correct. There are the two river sources. In your
21 estimation would those be the spring areas that would
22 constitute the ground water sources that Mr. Williams
23 has referred to?

24 A Both of these areas, the
25 river freezes to the river bed in winter so the only
26 water available, say during the latter part of the
27 winter, would be from a ground water source.

28 Q All right. Now, where
29 is it in relation to the rivers then?

30 A It is through the channel,

Clark, Dabbs, Harlan, Femstock
McCart, Minning, Williams
Cross-Exam by Baylv

1 beneath the channel.

2
3 Q So, to get at it, would
4 you bore a hole into the channel and pump it out?

5 A You could, yes.

6 Q Would that be what you
7 would contemplate doing?

8 WITNESS WILLIAMS: No, sir.
9 That was not contemplated in this drawing which was
10 done under my direction.

11 Q Yes. Well, since then,
12 Mr. Williams, I am assuming that ground water sources
13 have been considered?

14 WITNESS HARLAN: Not specifically
15 for water supply, no.

16 Q What about you, Mr.
17 Williams?

18 WITNESS WILLIAMS: In the
19 condition that I mentioned earlier if there is a
20 substantial flow from the spring that it can be taken
21 safely it would be considered, yes. It wasn't con-
22 sidered here. The bulk of the water that is shown to
23 be required here is for snow roads which take place in
24 the early part of the winter before the rivers freeze
25 to the bed and that was the intent when this was
26 drawn, to indicate that that would be from the normal
27 stream flow in the early part of the winter.

28 Q All right. Now, what
29 I would like to know, Mr. Commissioner, it appears
30 the panel is--I think, divided is too strong a term, but

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Pavly

1 there appear to be some different thoughts about
2 whether ground water would be used or not and whether
3 it would be taken from the bed of the stream or not.
4 Dr. Harlan says a possibility. Mr. Williams says
5 no, or at least no at the time that this plan was made.
6 I would like to know that and if it is possible for
7 Arctic Gas at some point to supply me with information
8 on water sources other than those on the map opposite
9 52-5 on the North Slope that would be contemplated to
10 be used.

11
12 MR. MARSHALL: Could you not
13 pursue it now? The problem is with these various
14 requests for information that we get so many of them
15 and people get called off to other inquiries and so
16 on and if it is possible at all, Mr. Pavly, to get
17 a resolution from the panel now, I would appreciate
18 it.

19 MR. PAVLY: Mr. Commissioner
20 I am prepared to do that but I was under the impression
21 that I had asked the questions and got the answers
22 that I had suggested required the panel at least to
23 go and talk to each other about it, to find out if there
24 are other possible ground water sources.

25 MR. SCOTT: Mr. Commissioner
26 I think I agree with Mr. Pavly that it is important that
27 it be resolved but can I say this and see if Mr.
28 Marshall agrees. First of all, there is nothing in
29 any of the material that suggests that ground water
30 is going to be utilized including the prepared evidence.

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Payly

1 for this panel. In the second place, ground water
2 becomes surface water when it is in the creek and I
3 presume that there is no suggestion, or if there is
4 I would be grateful to know that ground water before
5 it enters its water course, or something of that type
6 is going to be sought and used. Isn't that the issue
7 that has to be resolved, as a matter of fact, with
8 respect to Arctic Gas's intention?
9

10 WITNESS WILLIAMS: My

11 recommendation to Arctic Gas would be that if there
12 are springs with substantial flow that water can be
13 taken from without adverse effect to fish or other
14 wildlife or any other environmental reason that is
15 considered for use. But I don't think a decision can
16 be made on that today or tomorrow or next week. I
17 would think that decision would be made at the time
18 of construction. I just don't see how you can
19 forecast that.

20 MR. PAYLY: I am not asking
21 for a decision, Mr. Commissioner. I know that
22 decisions aren't made at this stage but we do have in
23 this case a map which shows intended or possible
24 intended sources. If there are any others that have
25 been thought of in the meantime and that may be so,
26 think that perhaps the Commission should know
27 them because I submit that it is not sufficient
28 they be left until final design. If somebody else
29 fish men for example say no, that wouldn't be a good
30 place. Why don't you take it from somewhere else?

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

MR. MARSHALL: Well, sir, we
get down to a level of detail in an amount of work
that is really incredible if we try to identify on
a very tight specific basis for all spreads and all
seasons, sources of water and indeed, I suppose in
some cases, borrow. Mr. Williams can indicate what
he would recommend. Dr. McCart is on the panel. He
can talk about water availability and he can talk about
his recommendations with respect to whether it is
acceptable or not acceptable to the withdraw water
from certain locations and I submit that is perhaps
as far as this panel is able to go and to take it
very much further as my friend is suggesting really
gets into final design.

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1
2 MR. BAYLY: Mr. Commissioner,
3 we've seen in the evidence of this very panel slides
4 which show us sources that have been identified as
5 coming from ground water, and they have been photographs
6 in the wintertime, and Mr. Williams says that perhaps
7 these would be sources, if they were flowing and are
8 not likely to adversely affect fish.

9 I submit that if his thinking
10 has got to that stage, and we're starting to see pictures
11 of them, then at least somebody's been there. Now if
12 somebody on the panel can give us an idea of what
13 these possible sources might be today, I'd be very
14 grateful, or perhaps on the water portion of the
15 this panel's evidence; if not, and I would submit that
16 if the thinking of Arctic Gas has got to the stage
17 where certain other water resource areas are to be
18 tapped, or they're contemplating tapping them, we should
19 hear about them.

20 MR. MARSHALL: We told you
21 that Dr. McCart has done some work on water availability
22 along this area, and he is in a position to talk about
23 that. He's also done extensive work on fish in the area.

24 MR. BAYLY: All right.

25 MR. MARSHALL: So if it
26 wouldn't be construed as leading, I'd like him to
27 deal with those subjects then and I think that will
28 go a long ways towards providing the information that
29 you require.

30 MR. SCOTT: Mr. Commissioner,

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 can I ask a question first? Is the distinction between
2 ground water and surface water for these purposes that
3 the latter, surface water, can be taken from a creek,
4 stream, spring, a surface or what have you, whereas
5 ground water can only be obtained by in effect digging
6 some kind of well, because if the latter is contemplated
7 that's very different than the former.

8 WITNESS WILLIAMS: The latter
9 is not contemplated.

10 MR. SCOTT: That's what I
11 understood from Mr. Williams' first answer, but if
12 there was a spring there that appeared to provide a
13 source of water that was at the surface, he would
14 consider using it, if necessary, but that he wasn't
15 going to dig for it. Am I right about that?

16 WITNESS WILLIAMS: That is
17 correct.

18 THE COMMISSIONER: Well, the
19 argument at the moment is whether they should go
20 ahead and figure out where they intend to obtain
21 -- where they intend to take advantage of springs and
22 they don't even know where the springs are at the
23 moment, and what I'm concerned about is requiring them
24 to go ahead and do something now that may not be of
25 any real advantage to us. Isn't that where we're at,
26 Mr. Marshall?

27 MR. MARSHALL: Well, sir, some
28 work has been done, and Dr. McCart can speak to that,
29 and he can also talk about the concerns that he has with
30

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 respect to fish, and I think this is really going to
2 help Mr. Bayly.

3 MR. BAYLY: I'm content to
4 hear what he has to say, Mr. Commissioner, before
5 we --

6 WITNESS HARLAN: Could I
7 interject a second? In fact we do know where the
8 springs are, or at least most of them. We do have
9 measurem ents of water chemistry, of water quality,
10 temperatures. O.K., in my earlier response you asked
11 with regard to the rivers, and I mentioned that they
12 deal with specifically the Firth and the Malcolm. I
13 mentioned that they do freeze to the river bed. I
14 believe your question was how would you get to the
15 water, and I said, "Through a well." That's not to
16 imply that that's the technique we would use.
17 Maybe that was part of the confusion.

18 MR. BAYLY: Q So there would
19 be no contemplation of using this as a source of
20 water unless it were free-flowing and accessible
21 without having to dig or drill for it.

22 A That was my intent,
23 yes.

24 Q Now, before we leave
25 Dr. McCart, who I understand has a knowledge of this
26 area on the ground water, I'd like if we could, Dr.
27 McCart, as much as possible to restrict this to ground
28 water, as I understand we're trying to restrict our
29 questions on water till the next round. I don't feel
30 that you can talk about them as they relate to each

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bavly

1 other.

2 WITNESS MCCART: It's very
3 difficult, in fact, to discuss ground water unless I
4 know the location of ground water on the North Slope,
5 without also being concerned about the position and
6 location of springs.

7 Q Well, let's break the
8 rules then.

9 A I can identify major
10 aquifers in the area by the existence of springs
11 where the water comes to the surface.

12 Q Well, where are they then?
13 You can identify them, the major ones, by pointing to
14 this Map 152-5, can you?

15 A Yes, I have a data record
16 of observations that we made this past summer. We had
17 two, I think on two occasions our people went up and
18 examined them and made measurements, and I can give
19 you the locations of the larger springs on the slope
20 in the Northern Yukon. First of all there is one on
21 Craig Creek, just inside the Alaska-Yukon border. Now
22 what I'm discussing here is the surface manifestations
23 where the ground water comes to the surface. It's
24 three miles south of Milepost 197.

25 Q I think we have that
26 spot, yes.

27 A There's another one on
28 the tributary of Craig Creek. I can give you the
29 quantities, incidentally, if you're interested in
30 the quantity of water which we found there. In the

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 first instance we calculated the discharge at 34.9
2 barrels per minute.

3 Q Yes, go ahead.

4 A We found no fish
5 present. There's a small spring on a tributary to
6 Craig Creek two miles south of Milepost 198, 121.3
7 barrels per minute. We found no fish.

8 There's a spring on Fish
9 Creek which is two miles north of Milepost 217.5. 163.7
10 barrels per minute. There are Arctic char present
11 there, small numbers of Arctic char, I should point out.

12 The Malcolm River, there's
13 a spring on the western portion of the delta --
14 excuse me, the eastern portion of the delta of the
15 Malcolm River, two miles north of Milepost 225. 237.8
16 barrels per minute. Both Arctic char and Arctic grey-
17 ling were present in the spring stream.

18 Q Was that downstream from
19 the water gathering area that's marked on this map
20 in the responses?

21 A Yes. There is a spring
22 which we call Firth Spring No. 2 in some of our
23 publications in the Biological Report series, specifi-
24 cally Volume 15, where we have a paper discussing
25 springs on the North Slope. You might want to refer
26 to that for additional information. This is 2.2 miles
27 north of Milepost 227. There are 277.9 barrels per
28 minute, and there are Arctic char present in this
29 particular spring.

30 Q Again I understand that

Clark, Dabbs, Harlan, Hemstock

McCart, Minning, Williams
Cross-Exam by Bayly

1 that's down the stream from the site that you contemp-
2 late taking water from?

3
4 A That's right. I think
5 this is the one I referred to a few days ago. Someone
6 asked a question about whether we had ever thought
7 that an elevated pipeline might be a worthwhile con-
8 sideration, and we were concerned about this one
9 which is downstream.

10 Q The one with the nitrogen
11 bubbles?

12 A Yes. There's another
13 spring on the western -- mid-western portion of the
14 Firth River Delta, 602.4 barrels per minute, and there
15 were a few Arctic char present there.

16 Q And is that downstream from
17 the cross-hatched lakes where you contemplate taking
18 water?

19 A Let me check that.

20 Q That's approximately
21 Mile 230.

22 A I'd say yes, it's down-
23 stream from that area.

24 Q Would that water be in
25 any way related to the water in those lakes, would
26 they be part of a common system in your opinion?

27 A No, I don't think that
28 this water would be related to the lake water at all.

29 Q All right. What about some
30 of the other springs? If I may interrupt, on the larger

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1
2 rivers, you've referred to springs on both the Malcolm
3 and the Firth River as being ones downstream from
4 where you would anticipate taking water.

5 A No, what I said was
6 that these were downstream of those areas indicated
7 on this map that we were discussing earlier.

8 Q I realize that, but what
9 I'm asking you really is, have you an opinion as to
10 whether the water travels through the ground from the
11 place where you would like to take water to the springs
12 that you have identified?

13 A Well, this is of course
14 a point of issue at the moment. We don't know how
15 deep these aquifers are. For instance, the Firth River
16 Spring 2, which I referred to, the one with the
17 nitrogen gas bubbles, we suspect that this is a
18 rather deep aquifer because of the presence of
19 nitrogen bubbles. Normally they're not present in
20 shallow aquifers, and secondly because the spring
21 water contains sodium chloride in a relatively high
22 concentration, indicating that it passes through beds
23 of evaporite. Our indication in talking to Dr.
24 vanEverdingen of the Inland Waters Branch, I think, is
25 that this is probably also indicative of a relatively
26 deep aquifer. So it's probable that this particular
27 spring is relatively deep. The others we really don't
28 know at this time just how deep the aquifers are, and
29 we have suggested that in these instances there should
30 be a drilling program, wherever a major spring water

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 source, particularly those containing, fish occurs
2 downstream of a pipeline crossing.

3 Q All right.

4 A To assure ourselves
5 that we are not going to interrupt the flow of ground
6 water.

7 Q Yes. Now I've interrupted,
8 you. Were there others on the North Slope that you
9 wished to refer to?

10 A There are a few others.

11 Q I'm speaking mainly of
12 the major ones. I'm sure there are small ones that
13 you haven't mentioned.

14 A One other is Crow River
15 Spring. You saw a picture of Crow River Spring in the
16 slide presentation. This is two miles north of Milepost
17 268, and flows at approximately, at the time we were
18 there at least, 93.7 barrels per minute, and we have
19 not found fish there. We visited this particular spring
20 on several occasions over a number of winters and if
21 there are fish present at all, they must be in very,
22 very limited numbers. We yet have not seen any.

23
24
25
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30

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

Q Now the balance of
these are downstream of the proposed pipeline route,
is that correct? With the exceptions of the ones on
Craig Creek and its tributary.

A I missed the one on the
Spring River, incidentally you also saw a photograph.

Q Spring River?

A Yes.

Q And where is that on
the Spring River?

A Dr. Harlan shows a spring
or a seep two miles upstream of the route. My map
shows it downstream, according to this one. This, I
should point out, is a rough copy that we put together
/on
the last day before coming up here, so there may be
some error in that particular location.

Q And these are the result
of the survey taken this summer, is that correct?

A That's right. We have
other information. Dr. Harlan has other information.
We have other information, other discharge information,
other water quality information taken in previous
years, I think beginning in 1973, and also information
for '74 which hasn't been incorporated into this.

Q And that's in your Volume
15?

A That's right. This is
/very
the result of a recent survey.

Q All right, are these
additional ones the ones in Volume 15 then, or are they

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 just supplemental information on the ones that have
2 previously been identified?

3 A Well, in part they're
4 supplemental information on ones that have previously
5 been identified and in a few cases we have identified
6 a few springs that we weren't aware of, although
7 Dr. Harlan may have known of the two springs in the
8 Craig Creek area. We knew of one, not of the other.

9 Q And these have all been
10 identified as -- sorry, not all of them -- many of them
11 have been identified as areas in which there were
12 either small or significant numbers of Arctic char or
13 char and greyling.

14 A Some of them have no
15 fish populations that we have found over the years.

16 Q And then some of them
17 have just been discovered for the first time this
18 season.

19 A Maybe one.

20 Q Which one is that?

21 A As I say, the one on
22 Craig Creek. One of the ones in the Craig Creek
23 drainage. But all of the major ones, of course,
24 are easily identifiable because of the presence
25 of rather extensive augeis areas downstream of them.
26 These can be identified from ERTS inventory or from
27 air photographs, or simply by flying through the area.

28 Q And you're saying that
29 the problem that you're facing now is to determine
30 what are the things that are likely to interrupt the

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1
2 flow of water to or from these ground water sources,
3 and you want to make sure that the pipeline isn't
4 one of those things.

5 A I missed the last part.

6 Q You want to make sure
7 that the pipeline isn't one of the things that is
8 likely to stop or interrupt the flow of these
9 wherever possible.

10 A Yes.

11 MR. BAYLY: I'm content with
12 that, Mr. Commissioner, in this area, and I'm assuming
13 that any further study of drilling is for another
14 season.

15 Q Now, Miss Minning, I've
16 asked you if you would have before you the reconnais-
17 sance of the Alyeska Pipeline material source borrow
18 methods, being a report of Northern Engineering Services,
19 and you have a copy of that report?

20 WITNESS MINNING: That is
21 correct.

22 Q And if I could refer you
23 to page 4 of that report, on page 4 and page 5, there
24 are three general concerns and perhaps these are
25 questions in which Dr. McCart might want to comment as
26 well. There are three general concerns with taking of
27 granular material from river bars of braided streams,
28 and those are habitat loss or degradation, that is
29 habitat of fish, entrapment in ponds, and siltation
30 interfering with the incubation of fish eggs. Now are

1 these concerns that can be transposed to North Slope
2 streams in the Yukon as well?

3 WITNESS MCCART: Yes, in
4 general.

5 Q In general?

6 A Yes.

7 Q "And when you say "in
8 general", do you mean of specific streams like the
9 Malcolm, Firth and Blow?

10 A Some of them. Habitat
11 loss and degradation obviously occur on any stream if
12 one isn't careful in taking gravel. Fish entrapment
13 in ponds is a possibility on any stream. Siltation
14 interfering with incubation of fish eggs, along most
15 of the pipeline route the fish either spawn in the
16 spring before gravel removal is anticipated, or they
17 spawn in areas considerably removed from the pipeline
18 right-of-way. Spring spawners are of course basically
19 the greyling and the fall spawners would be the Arctic
20 char. In general Arctic char spawn upstream of the
21 pipeline route, although there are a few fish that
22 do spawn in some of the springs that we've mentioned.
23 But in these areas, these are not areas in which we
24 anticipate taking gravel.

25 Q All right, so if we have
26 basic concerns that borrow from active flood plains
27 of rivers, they are of two kinds:

28 (1) is that if Arctic Gas is to borrow from active
29 flood plains in the summer and fall prior to the use
30 of the borrow material, that some flash flood or

Clark, Dabbs, Harlan, Hemstock
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Cross-Exam by Bayly

1 occurrence of that nature will cause flooding of the
2 area and siltation that may affect the fall spawners,
3 the Arctic char, or that siltation caused by annual
4 spring flooding may cause siltation to greyling spawning
5 areas if there are any that are downstream of the
6 borrow site.

7 A Well, we're not very
8 much worried about the possibility the greyling
9 will be affected because heavy siltation during spring
10 flood of course occurs when the stream is normally
11 heavily silted, as a result of the freshet moving
12 down. Our major concern would be if there were areas
13 where Arctic char were spawning downstream, where,
14 because they begin spawning in some situations in late
15 August and continue on through September and October,
16 and these would be the times when it would be proposed
17 to actually windrow the gravel and move it out.

18 Q You're not suggesting,
19 though, Dr. McCart, that natural siltation is good
20 for fish. It's just a hazard that fish have to put
21 up with.

22 A It's not a hazard to
23 the fish. The fish obviously, his life cycle, life
24 history is adapted to the normal cycle of events in
25 the stream, so ^{/that} while greyling are on the move, during
26 the course of the spring flood they don't actually
27 spawn until the flood is subsiding; but the water is
28 in some instances still somewhat turbid at the time
29 when greyling are spawning. This is not true, however,
30

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1 of Arctic char.
2

3 Q Turbid water, if the
4 silt happens to precipitate on a spawning bed, might
5 well destroy some of the eggs, is that a possible
6 condition?

7 A Yes, absolutely.

8 Q And that could be natural
9 siltation and part of the natural process, the natural
10 kill.

11 A Yes.

12 Q And additional silting
13 therefore is what you're concerned about, but it
14 doesn't mean that natural siltation doesn't kill some
15 fish eggs.

16 A It certainly does, yes.
17 Flooding very often kills them.

18 Q And so additional silting
19 has the possible effect of killing more fish eggs.

20 A Yes. Let me point out
21 that we would be totally averse to any gravel removal
22 source in an active flood plain where we thought that
23 it might in fact damage the spawning or the eggs in
24 the gravel of any population of fish.

25 Q All right. Now, the
26 main sources, as far as gravel borrow sites on the
27 North Slope of the Yukon are concerned, as I understand,
28 are those braided channel streams that I have mentioned.
29 The Malcolm, the Firth, and the Blow. Is that
30 correct, Miss Minning?

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1 If you were to take it from active flood plains.

2
3 WITNESS MINNING: Do you have
4 the site numbers? Quickly, it would help me.

5 Q No, I don't have the
6 site numbers. I'm just suggesting to you that if
7 you're going to borrow from active flood plains in
8 braided streams you're going to have to look for a
9 braided stream, and I've just identified three braided
10 streams.

11 A I think one of those
12 is actually a fossil flood plain site in one of those
13 rivers. That's why I'd like the numbers you're
14 referring to.

15 WITNESS WILLIAMS: 125 on the
16 Malcolm. 127 on the Firth. 137 on the Blow.

17 WITNESS MINNING: I think there
18 are seven flood plain sites. I've got numbers here
19 for at least six of them, now I can look them up.
20 I have our active flood plain sites.

21 Q And they are the ones
22 in between the Demarcation Point and Shingle Point,
23 on the various rivers involved.

24 A Yes.

25 Q All right.

26 MR. SCOTT: Have you got
27 numbers for those six?

28 A The numbers? I'm
29 obviously missing one. 125, 127, 137, 133, 124, GM-34.

30 MR. BAYLY: All right, am I
correct in assuming that there is one on the -- on each
of the rivers I've described?

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A In the rivers you mentioned
yes. There are flood plain sites
on those three rivers.

Q Now these three rivers, and
perhaps Dr. McCart can answer this, are these ones that
we could describe as being similar to the rivers that
visited in Alaska and observed the quarrying and borrow,
sorry, the borrow operations going on there.

WITNESS MCCART: The Blow River is
a little unusual and we hadn't been able to identify
any major spring water or ground water source on the
Blow River nor is there any arctic char population that
we have been able to locate. One takes them incidentally
but normally where there are no springs there are no
arctic char because they are dependent on these. The
Malcolm River is similar except that here again no major
arctic char population apparently utilizes the upper
course here so it is different than the Sagavanirtok
River in that sense. The Firth would be very
similar to the Sagavanirtok, a somewhat smaller
version.

Q Yes and you stated I believe
in volume 15 of the biological reports here is that
more books should be done in the Malcolm because it
appears that the research on the fish populations and
their areas ^{there} /hasn't been exhaustively done yet.

A Well that was written in I
think late 1973. We continued to look, other people
looked and nobody has come up with any convincing evidence

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of any major populations of fish in the Malcolm River.

Q Right. So really you are looking at the Firth as being the, one of those three which is most likely

A Yes.

Q And the concerns that you expressed, or that are expressed in the N.F.S. Report there, would certainly apply to the Firth?

A In the ^{Alyeska} Report, do you mean?

Q Yes.

A Oh are you speaking of this?

Q Sorry I am talking about the report done by Northern Engineering Service which I...

A That would certainly apply to the Firth, yes.

Q Yes. Now you have identified in volume fifteen of the reports here is figure ten of chapter seven, I believe cites of over-wintering on the Firth, that could possibly be affected.

22 A To my knowledge most of the over-wintering sites. certainly the major ones, are up stream on the pipeline crossing. We did several years study there and other then the springs in the Delta and the spring between the Malcolm and the Firth. we know of no over-wintering, let's say between the pipeline crossing and considerable distance upstream as far as Joe Creek.

Q Yes. The thing that is curious to me is that is on this map and I am a little

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confused by it and perhaps I should show it to you if I don't have a copy here.

A I have it.

Q It talks about red dots and hatch dots and the hatch dot on the Firth, covering a large area of the Firth delta appeared to be what is identified as a probable over-wintering area. Perhaps that is changed since this report ...

A Which page is that again?

Q I am referring to figure ten of chapter seven and the figures come after page eight of chapter seven.

A Oh, I am missing a figure. It did not get printed in this particular copy. Okay, again it is based on data up I think through 1973 and that time we did not have any precise information as to the location. We suspected it as an over-wintering area because we were aware that there was aulcius there. Since in one of the springs in fact, we investigated on our most recent trip was this one which lies to west, in the western portion of the delta, downstream of the pipeline crossing and there are in fact a few fish over-wintering there.

Q Is that the one that is identified as #41 on this figure?

A No that would be the, that would be Firth spring #2 that we have identified as #41 on that figure.

Q It is also downstream of the Putnam Crossing.

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A Yes but in fact the figure is incorrect in that the line or the stream actually does not, the orifice of that particular stream is approximately 1., two kilometres downstream, or 1.5 miles down slope of the pipeline. In other words the map here is in error. Our major concern there isn't that we are going to cross the stream **itself** but that we might, as I said, impinge on the aquifer.

Q So that the over-wintering area in this figure was on the west side of the Firth Delta, to the north of the pipeline.

A To the north of the pipeline and again it is a minor one. It doesn't included, It is basically juvenile, small numbers of small juvenile arctic char.

Q All right. So the ones that are spawning go farther upstream into Joe Creek and into the arm of the Firth to the...

A Yes. Also the bulk of the fish that are coming back from sea to over-winter also move
/ considerably beyond this.

Q So it is not a quick case of a large number of the juvenile population, but an isolated or small number.

A It is a small number and if I am not mistaken your basic fish, which have not yet been deceived for the first time. In other words, they are fresh water resident fish, they may go to sea subsequently, but they are rather small, haven't been to sea.

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yet.

Q Yes. Now going back to this report and the concerns that we might have on the Firth River and if it turns out that there are fish overwintering on the Malcolm even though it is not suspected, it may apply to that river as well. Now page six of that report refers to the fact that the pits have floor levels, or some of them and included in that is MS133-2 at the bottom of page six. It talks about a pit, with 70% of its floor above the water level, and I am assuming that is the water level of the active flood plan with water in a channel nearby. Is that correct? Perhaps Miss Minning would care to answer that?

A Yes.

Q And some of the sites you saw had pit levels below the level of the water flowing by in the channel. Is that correct?

A Yes.

Q And some of the floors of the pits had water in them?

A Yes.

Q Did you determine where the water came from, whether it had come-in from the top end, or whether it had seeped in through the material?

MR. HARLAN: I think the source of the water is quite obvious in that if you excavate below the water level, you are into the water table and there would be ground water seepage.

Q Yes. And it seeps in as

Clark, Dabbs, Harlan, Hemstock,
McCart, Minning, Williams.
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1
2 around the pit, I would assume, that some of that water.
3 even without flood conditions would come into the pit
4 through the berm or water underneath that would come into
5 the pit through the berm if the pit were lowered below
6 the level of the, of the bottom of the water containing
7 channel.

8 A If it were lowered to below
9 the level of the water, yes.

10 Q And during flood conditions
11 you may very well face the possibility of the bottom of
12 the pit being lower than the water level because the water
13 level has raised.

14 A Yes.

15 Q And therefore come through
16 the berm.

17 A Yes.
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Cross-Exam by Bayly

1
2 Q And I understand these
3 kinds of rivers where they come out of steep
4 mountains into braided river channels where the
5 channels shift from time to time. Even in a single
6 season, you may face the possibility that a storm
7 event will create this kind of problem which may very well
8 wash away your berm.

9 A I think if we know the
10 flow of water that the berm can be designed to withstand
11 that flood event.

12 Q Right. Now, you would
13 know this, I guess, on a river like the Firth or
14 you would begin to know it because you have got
15 gauges there. That is correct, isn't it?

16 A Yes.

17 Q So you would know as we
18 gathered more data what kind of maximum storm to
19 design for?

20 A Yes.

21 Q But you don't have gauges
22 on the Blow or the Malcolm?

23 A No.

24 Q And so you would have to
25 use your best guess looking at the topography to see
26 what--I think you call it design storm event- what
27 the maximum design storm which you could anticipate
28 would be while you are figuring out how to build your
29 gravel removal facilities?

30 A Yes.

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 Cross-Exam by Bayly

Q And you might be wrong?

A Yes. I think it would
 be wrong on the safe side though.

Q Now, when you design
 these facilities--you would be wrong on the safe side.
 You almost got that one by me.
 What you are saying is you try to be conservative as
 you can in these estimates?

A Yes.

Q When you are designing
 a pit like the ones that you have shown us diagrams
 of, you have do that a certain amount in advance
 when you go to quarry there. Is that correct?

A Yes.

Q Now, let's assume you do
 it in the summer to quarry two months afterwards and
 you have a storm in the meantime and the channel shifts
 in the active flood plain still, but shifts into the
 center of your pit. That is a possibility, isn't it
 because these channels are constantly shifting?

A Yes.

Q What do you do?

A You would have to move
 your pit.

Q All right. That is what
 I want to know because there is the temptation, I 'am
 sure, to move the river back.

A I can't see a shift
 occurring with that significance.

Q Well, there is the Keel

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1
2 River storm of 1970 to look back to.

3 A Yes.

4 Q I mean these are
5 possibilities that we have to face.

6 A That is right.

7 Q And you might find that
8 your gravel source that you had depended on was
9 radically altered in size by the, by a dramatic shift
10 in the river channels by a major storm event.

11 A Right. And you would
12 have to respond to the conditions at that time. I
13 don't think that we would reshift--want to reshift--
14 the river.

15 Q Right. So your plan
16 would have to be flexible enough so that you can gravel /take
17 either from a different source entirely or a smaller
18 amount from one side of an active flood plain than
19 you had anticipated because of a shift.

20 A I would think we would
21 want to have flexibility for that.

22 Q Yes. But you would
23 definitely not be prepared to change the river channel
24 to get back the pit that you wanted?

25 A Well, Dr. McCart has
26 indicated that he objects to rechannelling the
27 river and he appears to know what he is talking about.
28 We would accept his reservations.

29 Q Dr. McCart, after that
30 piece of flattery, are there occasions where you

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Cross-Exam by Bayly

would say it might be all right to rechannel in the
active flood plain?

WITNESS McCART: Well, there
may be instances if you took a very detailed look at
an area and you were convinced that in fact there were
no fish downstream, eggs or feeding fish because of
course you have got to be concerned, not only with the
fish, but primarily with their eggs because the
adults and juveniles are very, very tolerant of
high silt loads. But you have to be concerned about
the food that they are eating and stone flies and
mayflies and things of this sort are susceptible to,
populations of these are susceptible to damage
by siltation but if you are to convince yourself that
none of these in fact were likely to affect aquatic
populations and it might be worthwhile then or it
might be undamaging or not damaging to rechannel a
river, particularly if you were to do it at the time
of the year when natural silt loads were high in any
case, for instance in the spring.

Q But apart from that where
your general comment is to be against channelizing
the stream the way you saw it done in at least one
instance when you were in Alaska.

A I didn't, in fact, see
this in Alaska but Dr. Craik who works with us was
the man who wrote this report.

Yes, we are against it.
The other thing is I should point out that we do

Clark, Dabbs, Harlan, Forstner
McCart, Minning, Williams
Cross-Exam by Bayly

include in the evidence a statement that there will
a buffer zone left between the active channel and the
working area and ^{that} we don't intend to put a berm right
up against any active channel, there will be a
space there.

One of our objections, if
you read the Alyeska Report, one of our concerns at
least was in the Dietrich River which is not a North
Slope river but on the interior portion of the Alyeska
route is that the Dietrich River because of the
narrowness of the valley there were berms being pushed
up against and the streams was being up against active
channels and the stream was being channelized to some
extent there. We don't think this is good.

Q Yes, you mentioned that
on page 7 of this report and one of your concerns or
the concerns of your people in this was that in the
Sagavanirtoke River, turbid waters were released into
the stream late in the season, when you were worried
about the spawning activity you actually referred us
to in that river which I understand is--it is a pretty
active river for the spawning of *Salvelinus Alpinus*.
Is that right?

A Well, actually, except
for its very head waters, we don't know of any popu-
lations that actually spawn on the Sagavanirtoke.
They spawn in most of its major tributaries. It is
possible that round whitefish spawn in the Sag in
fall but there is no evidence and I have spent several

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McCart, Minning, Williams
Cross-Exam by Bayly

years working on that route. There is no evidence that I am aware of of any significant population of Arctic char actually spawning in the Sag except considerably upstream where Alyeska is working.

Q So the concern there, was not so much with the spawning, as with possible food sources being silted up by turbid waters being released?

A Or with the possibility of round whitefish, which are fairly abundant there which do not incidently occur in the Firth River as far as we know.

Q Yes. Now, referring to this report at page 11, one of the other concerns that, in the case of the visit made to Alaska did not appear to be a major one was that of dissolved oxygen and under 4.1 .2 .5, of that report, you stated that or the report stated that there is no significant reduction in the dissolved oxygen concentration in water body at the time of sampling even in a worse situation encountered. The oxygen concentration in the turbid affluent of pit MS124-2 was 11 parts per million and this value was similar to what was encountered in clear waters of this Saqavanirtok River which are 8 to 12 parts per million.

Now, that appears to be somewhere in the middle of those two values. What is critical and--

A Well, oxygen concentrations

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are a little unusual in that oxygen concentration can be inversely related to temperature. Higher temperatures, let's say 50°, the saturation, or 60°, let's say the saturation concentration of oxygen would be about let's say 8 parts per million whereas as the temperature falls the saturation values for oxygen are going to rise up to 10 or 12 or something like this so that this range of values may reflect. It probably-- I think if we looked at the temperatures, it was the oxygen values we are taking. We would not find that they were less than saturation and that this variability is the result of variabilities in water temperature.

As far as salmonid fishes go, most people in the field, feel that maybe four parts per million is a critical value for most species of stream dwelling salmonids, but there is considerable evidence that populations of Arctic fish, a number of species are tolerant of values considerably below this.

Q All right. So this parts per million means more if we know what the temperature is. Does it also mean more if we know what the level of the turbidity is because as I understand it if there is silt in the water suspended it may get into the gills and make it difficult for the fish to convert the oxygen which is in the water so the levels by themselves may be less significant than the levels in combination with the amount of silt flow. Is that correct?

Clark, Dabbs, Farlan, Ferstock
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Cross-Exam by Payly

A Well, this is the common
Sense analysis but I am not aware of any study in
which someone has simultaneously varied oxygen con-
centration and silt loads.

Q I see.

A To determine whether
in fact this does occur but this is the notion.

Q Is that to say that common
sense doesn't apply or just hasn't been studied?

A Oh, I think it probably
applies all right.

Q Yes, but it is something
in which there is no documentation or--

A Not as far as free-living
fish goes. We know there is certainly a siltation
and oxygen level certainly affect eggs and there have
been a fair number of experimental studies on this.
This is a somewhat different sort of situation.

Q Yes. But it would some-
thing to be avoided even if only from a common sense
point of view?

A Yes. I think we have
repeatedly stated that high silt loads are very much
to be avoided in the vicinity of over-wintering
or spawning areas during the winter when silt loads
are normally very, very low.

Q Would it make any sense
to, if you get into a ponding situation then rather
than to open up the berms to pump the water up hill

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Cross-Exam by Fayly

and let it filter its way back down to the stream?
From the point of view of avoiding the turbidity?

A Our recommendation has
been avoiding the turbidity you take it out of the
lower end of the working area, pump it up to the top.

Q I don't mean pumping it
upstream so much as pumping it out of the flood plain
itself.

A Oh, out on to the
fossil flood plain so that it percolates through.

Q Yes.

A Well, this might be a
technique that you might want to use in certain unusual
circumstances. Yes, I think it better to avoid ponding
altogether if possible by (a) not taking the material
down to the point where you are below the water table
or (b) filling in any holes before you in fact open
the berm.

Clark, Dabbs, Harlan, Hemstock
McCart, Minning, Williams
Cross-Exam by Bayly

1 THE COMMISSIONER: Mr. Bayly
2 would this be a convenient time to adjourn for today?

3 MR. BAYLY: It would for me,
4 Mr. Commissioner. I have some questions on one other
5 area, Mr. Dabbs' area, perhaps 15 or 20 minutes of
6 questions.

7 THE COMMISSIONER: 15 or 20
8 minutes of questions, that doesn't allow any time
9 for answers.

10 Mr. Veale, you are going to
11 be with us tomorrow?

12 MR. VEALE: Yes.

13 THE COMMISSIONER: All right,
14 well nine o'clock in the morning.

15 (PROCEEDINGS ADJOURNED TO NOVEMBER 6, 1975)
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